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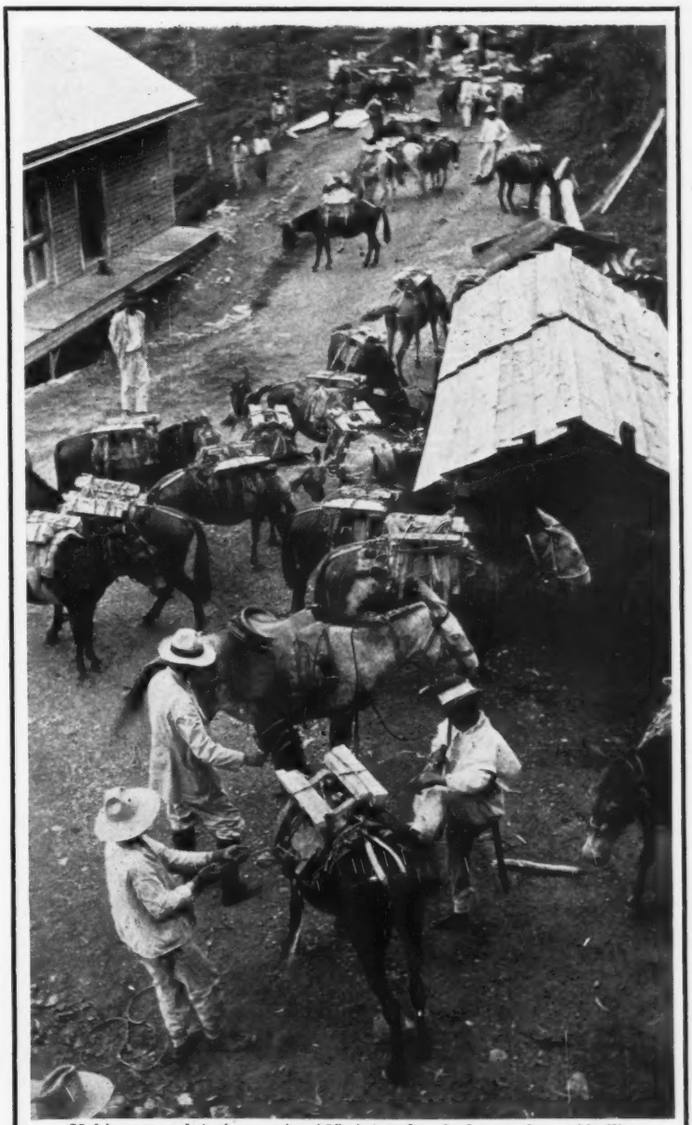

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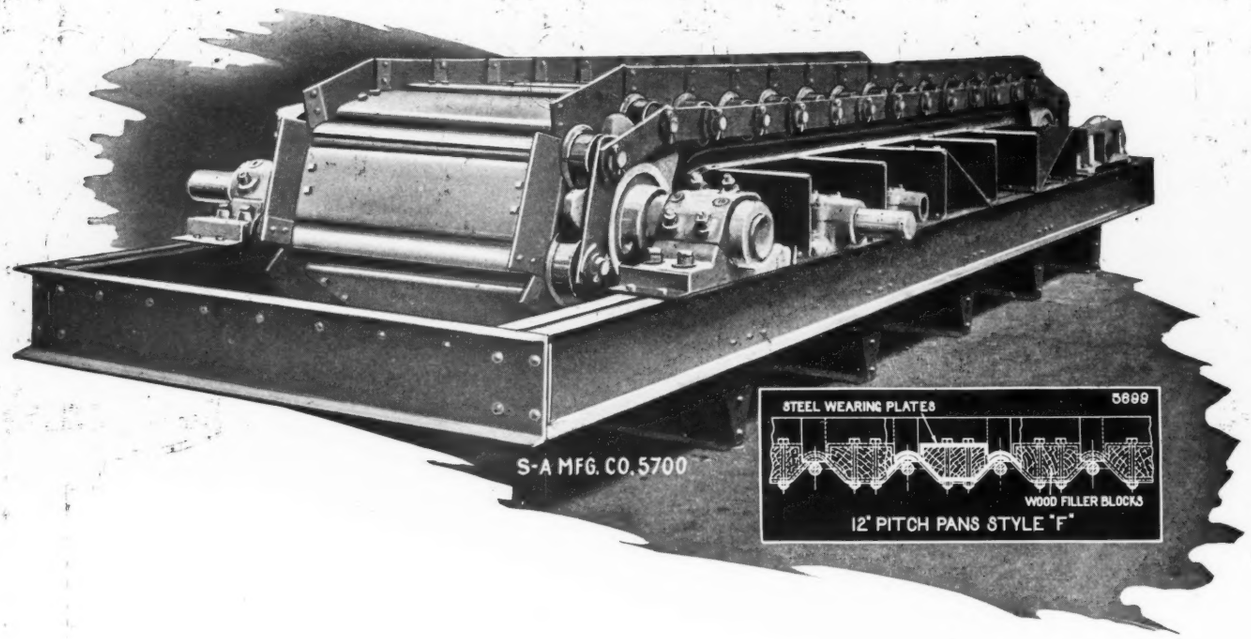
December 9, 1922



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Volume 114 | New York, December 9, 1922 | *Number* 24

Labor and the College Graduate

AMBITION and the will to work alone insure success, in the opinion of Thomas A. Edison, according to an interview recently published in the daily press. He discredits the efforts of the colleges and belittles the value of a college education. The former, he says, fail in their purpose. The students and graduates object to work, particularly dirty work, and are disappointing.

This is a sweeping generalization; but pungent comment on important matters is the only type that invites adequate attention. We are particularly interested in what Mr. Edison says, because his impression coincides with that of a prominent mining engineer in the West, whose career has been used, on many occasions, as an object lesson to those who aspire to emulate the successful, and who has gone out of his way to provide employment in the mines under his control for college men seeking practical experience underground. The results, he admits frankly, have been uniformly disappointing. The students object to work, particularly dirty work. They expect, as Mr. Edison has discovered, to be promoted in a few weeks. We suspect that the movies have something to do with this, for the successful engineer of the silver screen is invariably portrayed as a youthful individual who achieves the pinnacle of his ambition by doing something dramatically clever at the right moment. College graduates should bear in mind the fact that opportunities that are manufactured by the scenario writer have no counterpart in real life.

We have only one preliminary suggestion to make to college authorities: The inculcation of a sense of intellectual humility among those of immature experience—an appreciation of the fact that the real education of the graduate begins when he leaves college.

The 1922 Annual Review

ON January 20th of the New Year we shall publish our fifty-fourth annual review for the preceding year. *Engineering and Mining Journal* was founded in 1866; the *Mining & Scientific Press* in 1860. The latter journal did not develop the practice of an annual review, but in 1868 the *Engineering and Mining Journal* published a comparatively remarkable review of all metals. This was the beginning of the series of annual reviews. In succeeding years the practice grew of extending the annual review over several numbers in January. The first issue of the month, a review of the coal trade would be given; in the next, a review of the metal markets; in the next, a review of the iron markets, and later, perhaps, a review of mining stocks. This systematic handling began in 1875, the annual statistical and other review elements between 1868 and 1875 having been slight. In 1872 and 1873 there was nothing. After 1875, however, the annual review was kept up. From 1887 to the present date the annual review was confined to a single number, instead of running through several numbers, with the exception of the years 1893 and 1894, in which, again, the review was scattered through the January numbers. We expect to make the annual review still more of an institution in the future than it has been in the past. After some experimenting under the present administration, the review has been cast into a form which it is believed will be, relatively speaking, stable. The next review will contain carefully selected articles, planned to utilize the available space most efficiently, with those facts and opinions which are considered most vital to the mining industries

We intend to make the annual review still more of an institution than ever before: and this year's, in accordance with those plans, will come out under the title of Fifty-fourth Annual Review and Year Book. Bound copies, with index, may be ordered in advance.

Cost per Ton Milled or per Unit of Metal Recovered

IN AN EDITORIAL on June 5, 1920, we discussed the relative advantages of keeping costs per ton of ore or "rock," compared with cost keeping based on the unit of metal produced—pounds or ounces, according to the nature of the metal: and we argued strongly in favor of a general change to the latter system, as more informative to the stockholder and a better and safer guide to the operator. We pointed out the use of this method in the Lake Superior copper region and the increasing tendency to figure costs on the same basis for other copper mines; although many of these other mines still kept their actual cost statements on the ton rather than on the pound basis. We further argued in favor of such a metallic basis of cost keeping, not only for copper, but for other metals—even for silver and gold—in which latter cases the cost sheets would be kept on an ounce basis instead of an ore-ton footing. We pointed out that the real function of cost keeping and careful operating was to follow the unit of metal from the stope to the market; and that where we figured our costs on ton of rock, but marketed pounds or ounces of metal, a universal and direct comparison and following through was rendered difficult. We showed that, in order to make low ton-costs, managers are often tempted to make high ounce-costs, because the former sticks out in their reports to the board of directors, and is compared with ton-costs of other mines; but the really vital figure is concealed.

We are glad to see that this same thesis has been taken up by a South African mining engineer and that he advances the same obvious arguments that we did. Mr. W. A. Quince, in a recent issue of the *Journal* of the South African Institution of Engineers, maintains

that the statement of cost per ton milled should be discarded in favor of one that gives cost per ounce of gold recovered. Increased tonnage milled, he points out, means decreased cost per ton, but this does not necessarily infer an improved efficiency or the introduction of economies. At times an increase in the cost per ton milled may mean the application of better mining methods and the successful elimination of waste from the material going to the plant.

The question of the appropriate statement of cost is one that deserves closer attention on the part of technical men. The arguments in favor of the cost-per-pound or cost-per-ounce standard are convincing; but it may be further pointed out that if such a system were used alone it would be impracticable to compare the cost of operations on ores in which the metal content varied. The best plan, perhaps, would be to estimate and report cost per ton of ore milled as well as the cost per ounce of gold, for example, recovered, thus providing data that would be useful for comparing the costs at different properties during the same period, as well as on the same property during different periods. In the end, however, it is the cost-per-metal unit standard which is of the greatest use and the best guide to a mine operator in his specific problem.

Prohibition and the Turk

A SUBTLY HUMOROUS aspect of grave international problems is contained in the news from Constantinople that "nationalist Turkey is striving to emulate the United States in regard to prohibition." The Associated Press states that Rear Admiral Bristol, American High Commissioner, has received a request from the Green Crescent, Turkey's national anti-alcoholic league, for copies of the American dry laws and an account of the measures taken for their enforcement. "The United States has taken the lead in this high moral cause," says the Secretary's letter, and "we are eager to follow."

This looks like another dastardly plot. Will not the Allies object to such drastic measures against the Christian minorities? The Turks have always been prohibitionists—it is part of the Mohammedan religion; but they have never dreamed of imposing their views in this respect on their hard-drinking Christian and Jewish subjects. They have been too tolerant for that, believing that if the Christian religion involved alcoholism, why let the Greeks and Armenians go to it! It remains for free America to show them the light. But if the Turks really wish to drive out their unruly alien subjects, the enforcement of prohibition would eliminate the Greeks more neatly than the ancient and fabled massacre system. We await to see what sort of telegrams the churches will send the White House concerning this latest development.

Still more recently the Turkish Sultan has disclosed that there is no danger of Bolshevism in Turkey, since the Koran teaches the right to private property, and therefore Turkey cannot embrace communism. What will the American agitators for extermination of the Unbelievers say to that—contrasting the Infidels with Christian Russia?

And, still later, the report comes that the Greeks have massacred their own War Cabinet, including the Prime Minister. Will the pseudo-religious organizations wire to Washington to drive the Greek out of Europe? Oh, no!—no more than they objected to the Greek massacres in Asia Minor: for the Greeks are not like the Turks, who, it is explained in a recent incendiary circular sent to us and emanating from a religious organization, "do not believe in our God." The claim of special proprietorship and copyright privileges for the Deity recalls the similar German claims not so long ago; and the net result of all is to inspire unavoidable brooding doubts as to the future of America. At least we must be thankful that we have a level-headed Secretary of State in Washington.

Rand Metallurgical Practice

OUR CONTEMPORARY at Johannesburg, the *South African Mining & Engineering Journal*, takes us to task in a recent issue for an editorial note in which we commented on metallurgical modifications in progress at the New State Areas plant. As a preliminary to our reply, we hasten to explain that we gave full credit to the *Journal* for the description that appeared in our issue of June 17, on which our editorial note was based.

We are appreciative of the explanations now made, but we confess that they are unsatisfying. We opined, in the first place, that "Ore dressers will be inclined to inquire as to the advantage of selecting for the New State Areas plant a closed type of machine for secondary crushing. The ore is to be all-slimed, so that no advantage can be taken of the characteristic feature of the product from the disk crusher. Further, it matters not whether much or little slime be formed during secondary crushing; a large proportion might be desirable if it could be produced cheaply. The second main advantage in the use of the disk crusher is therefore lost." Such points are of interest, but our contemporary fails to respond, although our remarks in this connection are courteously repeated.

Secondly, we drew attention to the disadvantages of excessively long tube mills, such as are being adopted at the New State Areas plant. To this the *Journal* states that "it has been found by experiment that with a rapid discharge of pulp . . . the tendency is to increase the wear at the discharge end. This points to effective work being carried on at least up to 20 ft." To such a conclusion many will demur, holding that abnormal wear may be taken as one of the indications that conditions are unsatisfactory and that insufficient unground rock is present to cushion the blow.

We welcome information in regard to the "water circuit" and the "cyanide circuit," which removes a misapprehension. Our original objection to the statement that "This plant marks the beginning of a new epoch in the metallurgy of gold, not only in South Africa, but probably in the world generally," is maintained; for such a conclusion is misleading. The fundamentals of the process in question are by no means new; and the point we would emphasize is that, speaking broadly, methods of recovering gold from ore elsewhere will not be affected to an appreciable extent. The abolition of amalgamation and the adoption of all-slimming at a few plants in the Far East Rand are not likely to result in a general change of practice, other than in those instances where present procedure is at fault. The metallurgic results at the Springs mine, alongside the New State Areas, in contrast to those obtained locally elsewhere, have been unsatisfactory, and this evidently is the reason for the discarding of practice that has proved so uniformly successful in the past and is con-

tinuing to prove successful at the great majority of the mines of the Witwatersrand today.

The results at the New State Areas plant will be watched with interest; but we venture to predict that the "new metallurgy," which is but the recrudescence of a fundamental idea that was adopted as essential about twenty-five years ago at Kalgoorlie and elsewhere, will not be followed by those companies whose records show the successful application of normal methods to the treatment of a simple gold ore. We are glad that this discussion has arisen, for we feel sure that it will encourage an interchange of information and opinion that is needed to preserve a healthy technical progress.

Boosting the Red Metal

THE two principal contemporary activities of publicity men seem to be in promoting "Weeks"—such as Copper Week, Red Cross Week, Safety Week and Cancer Week—and in proclaiming contests for names, titles, and slogans. The first mentioned roll around with surprising regularity, and in a short time no doubt all fifty-two weeks will have been spoken for. A short time ago, F. P. A., of the *New York World*, remarked that, having received no notice of impending activities, it was evidently going to be a Weekless week. And as to the numerous contests mentioned, many of our readers are no doubt even now hoping against hope that they may receive the $100 in gold, or the grand piano, in time for Christmas. The difficulty of judging who is entitled to the prize for the best suggestion must be great. We are just in receipt of a copy of the entries in a contest for copper slogans, promoted by the Buxton-Smith Co., of Douglas, Ariz. A copper loving-cup was offered as first prize.

To illustrate some people's idea of a slogan:

"Be the man in our town
To buy Copper every minute,
Play golf and smoke,
Make life a joke,
For riches'll have no limit."

Or this:

"Boys and Girls:
Why not make happy the heart of Popper
With a snappy smoking set of Copper?"

Indeed, why not? And here is another that the judges must have had trouble in passing up:

"Make a roof of Copper
If you want it done proper."

Here is one which has the elements of cleverness if nothing else:

"Copper is the whole Cochise."

But there are several that must have had good chances for the first prize. The judges picked this one:

"Copper—the One Undefeated Enemy of the Elements."

We would have liked this better if the word "one" had been deleted. We wonder what the zinc people will say; and how about aluminum, tin, and nickel, not to mention the more precious metals on the way up to platinum? The second choice of the judges was:

"Copper—As beautiful as gold and as durable as iron."

This seems to us to sin the other way. Why make it of copper if that metal is no more durable than iron? We had almost decided that we liked the following the best:

"If built of copper you may forget it."

when it occurred to us that some cantankerous member of the Zinc Institute would probably remark, "Yes, you not only *may* but you *should*."

Boston & Montana Still

THE Boston & Montana management, whatever their honorable purposes may be, continue to provide classic examples of how a mine ought not to be promoted. The latest contribution is the report of a stockholders' committee. We have no doubt that it is an honest and honorable committee; but equally plain is it that the committee did not consist of mining engineers, but of laymen. One might as well have sent a committee of doctors, lawyers, manufacturers, and commission merchants to examine and report on an electric-power project or on the fortification of New York Harbor, or on the Muscle Shoals problem—far better, indeed, for a mining problem is much more complex. Note the following sample from the report:

"It would be most difficult to conceive of any intelligent person making even a most cursory examination of the underground workings in your Elkhorn mines, and not becoming enthused over the most favorable ore showings now in sight and the substantial tonnage of commercial ore that is reasonably assured. While your Stockholders Committee will not attempt to estimate the developed and partially developed ore reserves in the Elkhorn mines at this time, our investigations convince us that we are well within the bounds of conservatism when we tell you that there is an abundant supply of copper-lead-silver-gold ore, already in sight and being mined in the present workings, to keep the mill operating at a capacity of between 100 tons and 250 tons per day indefinitely. As development proceeds, the ore reserves unquestionably will be augmented, and with a larger force of miners, the output of your mill easily could be increased to between 800 and 1,000 tons per day."

The cold-blooded mining-engineer reader of this report notes that the committee is "enthused" (a bad condition for a mine investigator to allow himself to be led into) over a "substantial" tonnage that is "reasonably assured." The committee confesses that it has no idea *how much* ore there is, but it will keep the mill going at 100 to 250 tons per day "indefinitely"! Long enough! The mill, which has long since been finished, has a capacity of 800 to 1,000 tons of ore, and "according to latest reports" (we quote from the stockholders' report), "it was handling between 100 and 135 tons of ore daily."

"The mill bins were practically full of ore at the time your committee visited the property," etc. (The italics are ours.) So much for the mill bins: but we must keep our minds on the mine as a whole; and if the committee is satisfied with an examination of the mill bins, that is a huge joke for those versed in mining.

The committee further points out that the corporation has "a valuable asset in the Montana Southern Railroad, which now covers a distance of 38.3 miles," and proclaims "We Have Faith in Boston-Montana."

What the report as interpreted by men experienced in mining loudly proclaims is that the Boston & Montana has built a railroad 38 miles long to an undeveloped mine and has further built a 1,000-ton mill which it is able to supply with only 100 tons or so a day, and that apparently not uninterruptedly. In the meantime the public has been exhorted and enthused, and sold stock. The report really clinches the fact of a capital sin against the methods of intelligent mine operation and mine promotion—such an offense against intelligent mining as is so frequently indulged in by "practical business men experienced in financial affairs," which the stockholders' report assures us the directors are. We believe it. We know the type, and what havoc they can create in a mining enterprise.

Canadian Institute Meeting

By T. A. Rickard

THE Western meeting of the Canadian Institute of Mining and Metallurgy at Vancouver in November was particularly interesting to those who live on the southern side of the unfortified boundary that unites the two English-speaking peoples of North America, because it was distinguished by a lively discussion of problems similar to those that are agitating the members of the American Institute of Mining and Metallurgical Engineers. The main topics were the expansion of membership and the future of the Institute bulletin. The discussion was based upon two papers: one by the Secretary, Mr. George C. Mackenzie, and the other by Mr. H. G. Nichols. The Secretary wishes the Institute to represent the mining industry rather than the mining profession; he advocates a "catholic policy whereby the Institute should welcome as members not only those actually and professionally engaged in the allied industries of mining and metallurgy but also those individuals who are interested in the welfare of these industries". On the other hand, Mr. Nichols wishes membership to be restricted to persons properly qualified by technical training and experience, but to them he would add a class of Associates, which is to include "all who are legitimately interested in the Industry, and acceptable to Council". Mention was made of mine-owners as acceptable Associates, but if the mine-owner is accepted, why not the shareholder in a mining company? Where is the line to be drawn? "Acceptable to Council" is a clause of generous comprehensiveness. Mr. Nichols asserts that the Institute idea is to "guard the mining industry through the engineering profession"; the purpose of the Institute being, he says, "the exercise of professional obligations"; and "the inclusion of any units not obligated by virtue of such profession would be a source of internal weakness, operating to reduce the efficiency of the association". Before proceeding further I think it well to state that the Canadian Institute has a membership of 1,520, of whom 92 are Associate Members, 799 are Members, and 629 are Professional Members. The guiding spirit is that of the professional members, and for that reason the Institute enjoys an excellent reputation among organizations of its kind. What is it to be in the future—a technical society or a mining congress? that is the question. Can Canada, with a population of eight million people scattered across a continental area 3500 miles wide, support both an organization of engineers and another of business men interested in mining affairs? The population is large enough, and intelligent enough, to accomplish the feat, but the geographic difficulty is dominant. This same geographic obstacle is felt in the United States; on the other hand, the centralization of the British mining profession in London is one reason why the Institution is so successful in promoting solidarity and stimulating a high code of professional conduct.

The next subject discussed at Vancouver was the policy of publishing the monthly Bulletin of the Institute. Here I may say that the publishing activities of the Canadian Institute are more restrained than those of our Institute; nevertheless the Bulletin has proved a source of financial embarrassment, and is the direct cause of the proposal to lower the bar of membership, because thereby it is hoped to obtain the money needed to meet the deficit caused by a policy of exuberant publication. At Vancouver it was acknowledged that the cost of the Bulletin bears heavily on the Institute, and a referendum was made recently on the proposal to set a subscription price of $3 on that monthly publication. Various suggestions were offered: one was to use the 'Canadian Mining Journal' for the purpose of printing what now goes into the Bulletin; another was to obtain control of the 'Journal' for that purpose; and a third, made by Mr. Mortimer Lamb, the Secretary Emeritus, was to revert to first principles, that is, to cut down the Bulletin to its original form, omitting editorials and mining news. It happened that my address on 'The Duties and Privileges of Technical Journalism' dealt with this subject, with particular reference to our Institute and its monthly magazine; therefore, of course, I was keenly interested in the views of our Canadian friends in regard to the relationship between their own Institute and their technical press. It was acknowledged that the 'Canadian Mining Journal' had deteriorated during recent years, but there was no agreement as to who had "killed Cock Robin"; some thought that the decline in the 'Journal' and the expansion of the Bulletin constituted merely a coincidence, whereas I regarded it as a consequence. Some of the members thought that the injury done to the 'Journal' did not matter, as that periodical was of little importance; on the other hand, I urged that they never would have a forceful and effective technical press so long as they sapped it by their subsidized competition and that they were losing more by lack of a good technical mining journal in Canada than they were gaining by their own publishing activities, because, among other reasons, their Bulletin was not, and never could be, an independent critic—on the contrary, like the one in New York, it was bound to be under the thumb of a small and anonymous group at headquarters. The independence of the 'Journal' and of the Institute could be safeguarded by the Institute using a few pages, given gratuitously, in each issue of the 'Journal' for the recording of its papers and notices, but exercising no control over the policy of the 'Journal' nor having anything to do with any pages except those allotted to it for its own purpose, which would be to use a medium less expensive than the present Bulletin. On the whole, if I may advise our friends north of the 49th parallel, I would suggest that they revert to their former practice and issue a bulletin devoid of journalistic features —merely a pamphlet containing the notices of meetings, election of members, and so forth. There is no need to print the papers in the Bulletin; they are printed in separates, and the duplication of printing now in vogue looks like a needless extravagance. Some restraint in this department of its activities is required if the Canadian Institute, like our own, is not to seek solvency by aid of a nondescript membership; and when it seeks financial safety in that direction it will cease to be what it has been and become a mere mob (page Mr. Mackenzie), which means a promiscuous assemblage of persons, not necessarily "rude and disorderly", but having the characteristics of being mixed, not only in its constituents but in its ultimate purposes.

DISCUSSION

The Klondike Discovery

THE EDITOR:

Sir—Mr. T. A. Rickard's article in your issue of July 8 relative to the discovery of the Klondike gold field brought me memories of many pleasant associations. It is a pity, however, that Mr. Rickard, who is usually so well informed, did not in this case have access to more reliable sources of information; and while his article is obviously intended to be fair, it contains so many misleading statements that in justice to George Carmack, who was a friend of mine, I am moved to send you an authentic account of the facts pertaining to that memorable discovery.

It happened (if a little personal history is pardonable) that I was in that section of the country myself that summer. In the month of June I camped at the mouth of the Klondike for some time—panning and looking around, but left shortly before the strike for down river. In August I returned to Forty Mile a few days after Carmack had brought in the news of his discovery, and had exhibited, in proof thereof, several hundred dollars in coarse dust.

A mild spectacle had ensued and was still under way; but, incredible as it may appear, neither the sensational reports nor the sight of the virgin gold had aroused anything more than a passive interest. This was due, in part, to lack of confidence in Carmack's judgment in regard to mining ground, owing to his well-known sanguine, visionary temperament. But mostly it was due to a queer notion, held by nearly all the miners of that day, that there was no gold on that side of the Yukon River. The most these old-timers would concede was that what Carmack had found was merely a "spot" that would soon be exhausted. That, too, was my opinion, and not until Dec. 4, when I reached Dawson on my way to the "outside" from Circle City, did I finally awake to a realization of the phenomenal richness of the new camp and hear from Carmack's own lips the story of how he had stumbled upon the wonderful rim on Bonanza Creek. Briefly stated, the facts are these:

In the summer of 1895, Carmack and his partners had prospected on a tributary of Indian River that heads against Bonanza dome and was subsequently named "Quartz Creek." Having found encouraging prospects, they went back to it the following spring, to do further prospecting, and worked until about the middle of July, when, presuming that the salmon run had by that time reached the upper Yukon, they decided to return to an Indian settlement at the mouth of the Klondike, locally known as "Lousetown," and put in their supply of fish for the ensuing winter. Instead of going downstream by way of Indian River, however, they took a short cut across the hills in the hope of getting a moose on the way. The first day was easy; they merely crossed over the divide into the head of Gold Bottom Creek, where Bob Henderson was prospecting some shallow ground, and stopped with him overnight. But on the second day they reached a point well down in Bonanza Valley and made camp on a low bench, that afterward formed part of Discovery claim. After supper, Carmack, who was an inveterate panner, took a frying panful of gravel from the top of the rim rock, which at this place projected five or six feet above the running water, and on washing it, was amazed to find that he had at last struck it rich; those few handfuls of gravel had yielded several dollars worth of bright, shining gold.

They had only what few supplies they were carrying on their backs, and no tools, but fortunately had two large frying pans. With these they proceeded forthwith to take out a "grubstake," and by panning steadily recovered $700 in the next two days. They then named the Creek "Bonanza," and staked their claims; Carmack taking Discovery, while Skookum Jim and Tagish Charlie took one above and one below respectively. This was on July 26, 1896. They next made their way to the Yukon and thence to Forty Mile.

It is quite true that at that time other prospectors were in the Klondike district. Andy Hunker and partner on the large stream to which he afterward gave his name. As aforesaid, Bob Henderson and partners were on Gold Bottom, while Dan Savoy and a few other men were across the divide on the Indian River watershed. All were getting prospects, Hunker finding rich pay himself shortly afterward. A year later, he related to me how, in panning in the creek bed, he had struck a high point of bedrock, two feet down beneath the running water, from which he had obtained a $200 pan. Henderson, however, although he had set up sluice boxes and was testing the ground by shoveling in, never had anything that could, by any stretch of imagination, be called pay. How can he, then, be entitled to the credit of making the original discovery? Surely, if the discovery of a placer camp means anything, in its practical sense, it must mean the finding of a pay streak, or of pay dirt, and Gold Bottom never did show either, in spite of all the work that was done on it in after years.

The plain truth of the matter is that no one in the early days ever heard Henderson's name mentioned in connection with the original discovery. It was not until politics had invaded Yukon Territory, five or six years later, that the claim was put forth by interested parties who wanted the distinction to go to a Canadian. Without doubt, Henderson was a worthy man, and it seems like the very irony of fate that while surrounded on all sides by rich creeks he should have landed on practically the only barren one in that locality. Moreover, insofar as I can recollect, he never at any time located a valuable piece of ground. This, too, when rich claims were to be had for the staking, not only that summer, but for two years to come, as follows: Dominion, having perhaps the longest pay-streak of any creek ever discovered, being staked in the spring of 1897; Sulphur, another good creek, about three months later, while Gold Run, next to Eldorado the richest creek in the district, was not staked until 1898.

To assume that Carmack knew nothing about mining, or that he was a shiftless backwoodsman, is entirely erroneous. On the contrary, he was a highly intelligent optimistic worker of fairly good education and rearing. His love of adventure had sent him into the wilds of the North years before, where he had prospected, trapped, traded with the natives and learned their customs and languages. About six years prior to the Klondike strike, low-grade pay had been found on the Nordenskjold, a tributary of the Lewis, and on the strength of those diggings, he had established a small trading post at the confluence of those two streams. That venture, however, had proved a failure. Later he set up a somewhat more pretentious establishment at Sixty Mile, which he, however, subsequently turned over to Harper and Ladue. Carmack was a dreamer; like nearly all prospectors he believed himself to be a man of destiny, and had an abiding faith that some day he would make a rich strike.

For three years when Dawson was at its best, it was in every sense one of the greatest boom camps ever seen. From a half score tents and shacks in the spring of 1897 it grew as if by magic into a city of stores, music halls, saloons, gambling houses, hurdy gurdy houses, while hundreds of cabins sprang up like mushrooms everywhere.

On the creeks, gold dust by the hundredweight literally clogged the riffles, and as adventurers from every clime poured into the district, the producing gold belt constantly widened by new discoveries. Only two few, alas! of those who suddenly found themselves rich beyond their wildest dreams could resist the lure of the green cloth, or the wiles of the dance-hall sirens, but to Carmack the hectic pleasures of the night life meant nothing. With money to burn, he remained ever the same; a quiet, kindly, modest man; a loyal friend and a devoted husband and father. True, he was a squaw-man; but in those days nearly all the prominent men on the Yukon, miners and traders, including one venerable if somewhat unkempt bishop, had native wives, and a more decent, honorable set of men it would be hard indeed to find anywhere.

As I look back upon those distant days, what still impresses me as singular is the general apathy and lack of interest with which the news of the big strike was received everywhere. After a stay of three weeks in Dawson, I made my way to the coast, reaching Juneau on Feb. 4 and Seattle six days later. A handful of northerners from Circle and the Koyukuk were wintering in that city. To them and sundry others I imparted the glad tidings. I also gave an interview, stressing the importance of the new discovery, to the *Post-Intelligencer* that was published on Feb. 11, 1897. But mine, however, was a voice crying in vain in the wilderness; my glowing reports were entirely too good to be true and evoked nothing but good-humored, skeptical smiles. It was a different story, however, when in the following July, the gold ship "Portland" arrived in Seattle, and the news was flashed to the world that she had brought one ton of Klondike Gold.

Anchorage, Alaska. ALEX. MCCOMBER.

If I may step from the editor's chair to the floor of the house, so to speak, I should like to reminisce a little along with Mr. McComber and other old "sourdoughs." I have a clear recollection of "Lousetown," at the mouth of the Klondike; although I never saw Dawson. In June, 1896, a little boat, containing, besides myself, my fellow geologists of the United States Geological Survey, Goodrich and Schrader, and Pete Wiborg, an old Alaskan placer miner, floated down the Yukon from Chilkoot Pass. We intended to camp at the mouth of the Klondike, but the Indian village did not look attractive as a camping site, and we raced on to Forty Mile. Afterward, in August, when our party was at Circle City, having just come back from a tour of the Birch Creek diggings, Pete Wiborg, who had left us at Forty Mile, came to me and told me that Carmack had struck rich gold on the Klondike and that a group of the miners at Circle were going to hire the Alaska Commercial Company's river steamer, then lying at Circle, and go up the Klondike to stake claims. He urged me to go along, and stake or be staked for. There were obvious reasons why the temptation to this delectable adventure had to be resisted, so I did not go with "the crowd." Needless to say that many of the crowd, including Pete Wiborg, struck it rich. Mr. McComber's trip out from the Klondike to Juneau in February is still a legend in that country.

I returned to Washington and reported that the placer resources of Alaska were comparable to those which California had in the '49 days—in so many words. I drew up at the request of the Director of the Geological Survey (C. D. Walcott) plans for five exploration parties in 1897, but Congress failed to appropriate the money for the work that year; but it did so the next, so that in traveling up the coast of Alaska in 1898 to penetrate the Upper Kuskokwim country by way of Cook Inlet and the Sushitna, I witnessed the extraordinary spectacle of the Klondike rush, which had set in after so long an interval! J. E. SPURR.

The Salesman and the Institute

THE EDITOR:

Sir—In an article on the duties and privileges of technical journalism in the *Engineering and Mining Journal-Press* for Nov. 25 Mr. T. A. Rickard says:

"The printed discussions (of the American Institute of Mining and Metallurgical Engineers) are vitiated by matter a large part of which is suspect because it comes from prejudiced sources, notably the agents of manufacturers. Why they should be members of the Institute I fail to see. They are not mining engineers, metallurgists, or geologists; they may have been; they are functioning now as sales agents."

This, to my mind, is a narrow point of view. Many engineers were employed by manufacturers primarily because the job they have can best be filled by a mining engineer. Such men are daily using their engineering knowledge in their work, which is of direct service to the mining industry which uses the product they help to make or sell. Would not Mr. Rickard's limitations also exclude from membership in the Institute such able editors as Mr. Spurr and himself because they are now functioning as writers and not as engineers? True, Mr. Rickard's skillful use of the hammer might continue his classification as a geologist—but that is aside from the point.

I presented a paper at the San Francisco meeting of the Institute. The information it contained was obtained entirely through experience gained in the employment of a manufacturer of explosives. Even had there been any intention of including prejudiced information in this paper, any doubtful portions could not have survived the careful editing which the paper received before it was published.

Are not Mr. Rickard's discussions, clear and able as they are, on the duties and privileges of technical journalism equally open to suspicion that they come from a prejudiced source?

As one who both writes advertisements and decides upon the publication in which to publish them, I find much with which I can agree in Mr. Rickard's article, but it seems to me that he has abandoned good judgment and is giving vent to personal spleen when he would bar from membership in the Institute fellow engineers who, like himself, are employed by organizations directly serving the mining industry.

Wilmington, Del. N. S. GREENSFELDER.

How Shall We Get Honesty in Mining Engineering?

THE EDITOR:

Sir—"What's Wrong With the American Oil-shale Industry?" by Arthur J. Hoskin, in the Nov. 4 issue of the *Journal-Press*, was timely and should produce beneficial results. It is regrettable that it cannot be more generally read. The situation cannot be dealt with too poignantly, and Mr. Hoskins' satire is fully justified.

A similar situation exists in the mining industry. These charlatans who now pose as authorities in the oil-shale industry have likely gained at least a part of their experience assisting questionable mining operations—the operations, presumably, referring to that more or less painful process of relieving suckers of their rolls.

I believe it is generally accepted that the mere possession of an engineering degree does not necessarily imply that the holder is a capable and honorable engineer. Degrees are sometimes only the court-plaster of the incompetent. Impostors fundamentally devoid of the knowledge they claim should be ostracized. Engineers must, of necessity, make some miscalculations and mistakes in judgment because of the nature of their work, and, I believe, it is the general attitude that such mistakes, when made by an engineer who is practicing legitimately, should be forgiven and profited by. However, when men falsely assume titles to which they can lay no legitimate claim by right of degree or practice and experience, and cause not only financial loss to those who are victims of their perfidy but also loss of standing to the profession and industry they have attached themselves to, the situation merits serious attention. The chameleon-like ability of some of these men to change their professional title at will is remarkable. The public cannot be expected to have confidence in an industry so long as imposters are allowed to antagonize them by dishonorable practices. The situation has become so bad that even the head of a prominent school of engineering has capitalized his title as such by allowing it to be used to lend authority to his "reports" and publications.

One of the most familiar fakes in the West has the honor of having his name in your Professional Directory along with *bona fide* engineers. This man has become a familiar figure in Colorado during the last twenty-five or more years, and his process for "liberating" the gold in ores, or even in shale, I understand, catches a new crop of suckers periodically. He appears as a "metallurgical and consulting engineer" in your directory.

Legitimate mining is a legitimate venture, and capital risked in such ventures is a proper speculation or, in some cases, investment. Mining engineers should do all they can to make and keep it clean and honorable in the eyes of the public.

I do not know what suggestions have been made with a view of preventing the written reports or verbal statements of unscrupulous men being printed in advertisements, prospectuses, or articles that have for their purpose the selling of stock or securing of funds in any way for ostensible use in mining activities.

It is conceivable that a state commission could be appointed, composed of competent engineers representing the various branches of the mining industry, to whom all reports or statements of engineers or others intended for publication as any part of a campaign to secure funds must be submitted. This commission would not indorse the statements and recommendations made in the matter submitted, but could allow companies whose reports were of proper tenor to carry a statement to the effect that the commission had read such reports and that though they had no personal knowledge of the actual conditions, and could not guarantee them to be as represented, they believe no intent to deceive or defraud existed. A similar statement long used by brokers advises the public that information regarding securities they offer for sale is not guaranteed, but has been obtained from sources they believe to be reliable. The main benefit from the activities of such a commission would be the elimination of a great flood of prospectuses and advertising matter that contain reports by the familiar "eminent engineer," readily recognizable as plain bunkum, the elimination of which would work hardship only on the unscrupulous company and its aids.

The American Mining Congress or the American Institute of Mining and Metallurgical Engineers could be of great assistance in putting into effect any such plan if it were found to be sound. Whether or not such a system would be practicable, or whether it would lead to evils that would counteract the benefits, is open to debate. I believe that this subject merits the comments of those interested in the future of mining.

Chicago, Ill. D. H. FAIRCHILD.

Surface Tension and Flotation Phenomena

THE EDITOR:

Sir—The article entitled "Surface Tension and Flotation Phenomena," by Leeke and Jarvis, which appeared in your issue of Aug. 19, 1922, has attracted my attention. The authors have carried out some ingenious experiments and have recorded some interesting observations from them. They purposely have not interpreted the phenomena observed, or drawn any conclusions from them. Of course, such observations are of little value and decidedly misleading if left uninterpreted. Personally, it is hard for me to believe that the phenomena observed by Leeke and Jarvis are at all fundamental in flotation.

The apparent attraction or repulsion between objects floating on the surface of a liquid, or between an object on the surface of the liquid and the wall of the vessel containing the liquid, as observed by Leeke and Jarvis, are phenomena familiar to all physicists and are mentioned in many standard textbooks on the subject. I have observed the same kind of phenomena in making surface-tension measurements by the film method[1] in which a metal plate is used.

[1] "The Film Method of Measuring Surface and Interfacial Tension," by A. H. Fahrenwald, *Journal* of the Optical Society of America and Reviews of Scientific Instruments, September, 1922. Also see *Mining & Scientific Press* for Aug. 13, 1921.

Measurements of the surface tension of a liquid by this method must be made in fairly wide vessels. Unless the diameter of the vessel is considerably greater than the width of the frame used for forming the film, it is impossible to prevent the freely hanging plate from being drawn against the walls of the vessel. The same is true in making interfacial-tension measurements where the plate is suspended in the interface. However, in making any interfacial-tension measurement the plate may be either repelled or attracted by the walls of the vessel, depending entirely upon the contact angles made by the respective liquids against the vessel and the metal plate.

If a drinking glass be filled almost to overflowing, so that the surface of the water stands higher than the

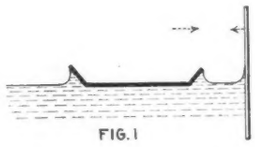

FIG. 1

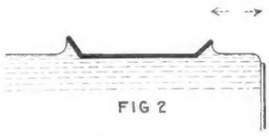

FIG 2

edge of the glass, the plate dipping in the water tends to remain in the center of the glass. There is no difference between the behavior of the plate when immersed in a liquid at a point near the wall of the vessel containing the liquid and that of the floating zinc shaving as observed by Leeke and Jarvis. The condition of the plus and minus zinc shavings (using

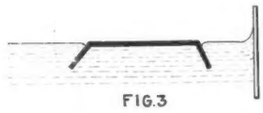

FIG.3

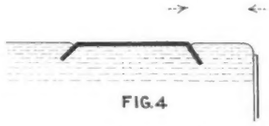

FIG.4

these terms in the sense given them by Leeke and Jarvis) floating on a water surface is presumably as illustrated in Figs. 1, 2, 3 and 4.

In each experiment only the bottom surface of the shaving is wetted by the liquid, let us say water. The top surface is not wetted, and it is for this reason that the shavings are able to float. If the adsorbed air is

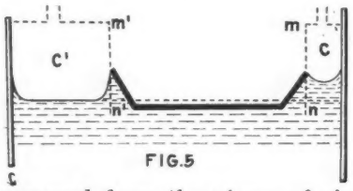

FIG.5

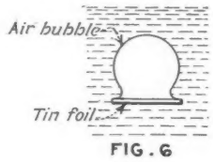

FIG. 6

removed from the pieces of zinc, and if they are perfectly wetted by water, they sink, and they cannot be again brought to the surface by the aid of air bubbles.

The fact that the "plus" zinc shaving strikes the wall head-on is due to the downward curvature of the water against the shaving at all points along the horizontal portion of the shaving, the curvature being upward at the ends only. Since like curvatures or menisci apparently attract and unlike ones repel, as Leeke and Jarvis observed, the pull is on the head of the shaving only, analogous to the towing of a boat upstream.

Now, the source of attraction or repulsion, as the case may be, and what it has to do with the causes of flotation, are other questions.

The force causing the movement of the shavings can be easily shown graphically. Take for consideration the case of the zinc shaving shown in Fig. 1, which, when sufficiently close to the wall of the vessel, moves toward and finally strikes it. The conditions prevailing at a given instant are shown in Fig. 5. Picture the two upward projecting ends of the shaving as forming walls, *m n* and *m′ n′* of imaginary chambers *c* and *c′*. If no capillary forces were at work the surface of the water in chambers *c* and *c′* would be on the same level; then, to maintain the water surfaces in these chambers at different levels a pressure or a vacuum would have to be created in one or the other chamber. If the pressure in *c′* were greater, the water level in *c* would be higher, and the shaving, one end of which forms the wall of a pressure chamber, would be forced to the right or toward the wall opposite to that with which it forms a pressure chamber. Now, capillary action in the comparatively small chamber *c* causes the difference in the water levels in the chambers *c* and *c′*, which, in effect, amounts to increasing the pressure of atmosphere in chamber *c′;* the result of which is a tendency for the shaving to move or be forced against the glass wall.

The next question is, What has this kind of reaction to do with flotation? Are the reactions fundamental? I believe that they are not fundamental reactions, but they may nevertheless play a certain rôle in the flotation process.

Leeke and Jarvis cite another experiment, wherein they cause pieces of zinc and tin foil that had been forced through the water surface, to sink to the bottom of the tumbler, to attach to bubbles and be again brought to the surface. This is another capillary process and a case of contraction or straightening out of surface films of like curvature as shown in Fig. 6.

Here the air is able to displace the water at the surface of the tin foil. I think there is certainly some question as to whether the pieces of foil, dropped on the water surface and forced to sink, are really wetted in the first place, for I find that if they are brought to the surface mechanically the water runs off them immediately. Furthermore, if such pieces of foil are thoroughly freed of adsorbed air films and caused to wet completely, before they are dropped to the bottom of a tumbler of water, it is practically impossible to cause bubbles to attach to them.

If flotation depends upon such capillary reactions, then, the process is clearly dependent upon the power of air to displace water at the surface of certain minerals and not at the surface of others. If this is so—and my mind is open to conviction—then in the modern flotation process oil must be the medium responsible for the degree to which air bubbles are able to engulf mineral particles. The fundamental reactions, then, are those of adsorption of oil by minerals and the reactions that make selective adsorption possible. These reactions I discuss in other papers which are soon to be published.

A. H. FAHRENWALD.

Moscow, Idaho.

Scientific Prospecting

THE EDITOR:

Sir—Two recent instances of the discovery of mineral deposits, the result of prospecting under technically trained men, have been related to me by a friend (C. M. Harris) in Western Australia, who remarked that while they had many men able to mine and treat ore, there were very few that had made a specialty of finding it.

1. The Geological Survey of Western Australia had supplied data on certain areas to the Prospecting Board, which in turn advised the government prospecting expedition to examine. Gold was discovered at several places, and the deposits are now being de-

veloped. The prospecting party is protected from a rush by outsiders by the reservation of the area in which it is working, and the deposits can then be thoroughly tested without hindrance.

2. A syndicate consisting mainly of mining engineers of Western Australia sent a graduate of the Kalgoorlie School of Mines to Malaya to prospect virgin country, with the result that good tin-bearing gravel was discovered. An engineer is now checking the boreholes put down, before a dredge is installed.

For years my informant has advocated scientific prospecting; also that it, with subsequent field work, be part of the training at schools of mines.

Pittsburgh, Pa. M. W. VON BERNEWITZ.

Deviation of Plumb Lines from the Vertical

THE EDITOR:

Sir—Referring to your article entitled "Deviation of Plumb Lines from the Vertical" in the *Journal-Press* of Oct. 28, the fact that air in motion is substantially the cause of the whole difficulty in mine shaft plumbing was well understood by many Colorado mine surveyors at the time of the noted experiments which you mention; and the discussion in the *Engineering and Mining Journal* at that time, and the various theories advanced to account for the variation from the vertical, caused smiles on the faces of many of us who were regularly doing that kind of work. But in those days all engineers in this region were too intensely busy to write articles.

In considering this matter I think that attention should be called to the great difference in the effect of an air current on short and long plumb lines and to the fact that the difference is not according to simple arithmetical ratio of the lengths of the plumbs, for the influence of the air current increases with the length in a geometrical ratio.

It is claimed by some mine engineers that for the most particular work one should plumb separately from level to level rather than hang plumbs, say, 1,000 ft.; while others are content with the simple rule, "Never hang your plumbs more than 500 ft." In my experience 300 ft. is usually quite reliable. It all depends on how strong the air current may be. I believe that the best possible result is secured by hanging the plumbs separately every 100 ft., or at each level where it is possible. The position and steadiness of the wires are more dependable and the slight imperfections in taking and fixing the azimuth at each level tend to balance each other. Besides, in shafts which have become out of true in places from swelling ground or other cause, greater distance between wires—a most important factor—can be secured in almost every case than if the wires are hung the whole depth at once.

Another point should be mentioned in connection with plumbing deep mines. Most deep mines have two or more shafts down to certain old levels. I have been surprised to find how many engineers fail to take advantage of the opportunity to hang one wire in each of two shafts as far down as the bottom of the shallower shaft. Then traversing between the two, above and below, gives an absolutely reliable and proven meridian, which is just as accurate as any other part of the underground work can be made, down to this level. This usually gets by the worst of the air currents. Then the plumbing to the deeper levels through the single shaft can be done in comparatively quiet air.

Denver, Colo. VICTOR G. HILLS.

The Argonaut Disaster

THE EDITOR:

Sir—I was glad to read the statements made by Mr. T. A. Rickard, before the investigating committee *re* the disastrous fire at the Argonaut mine, Jackson, Calif. For the first few days, statements were published, said to have been made by eminent engineers, which, if made by them, showed entire lack of the first principles of mine ventilation. I have made a study of the subject for many years—passed a mine manager's examination before a board of examiners consisting of the territorial inspector of coal mines, one mine manager selected by the Mine Managers' Association, and one coal miner selected by the miners of the territory of Wyoming in 1887. This examination is compulsory under coal mining laws—before one is entitled to a certificate giving authority to take charge of underground work in large coal mines.

Ventilation is one of the important subjects on which an applicant's knowledge is tested. Now, I feel qualified, if the statements published are true regarding the difference in elevation between the Muldoon and Argonaut shafts, to say that the fan at the Muldoon shaft should have been stopped at once when the fire was reported, and reversed, if possible, which would have greatly accelerated the smoke and gas through the Argonaut shaft and away from the miners working hundreds of feet below the fire. The cool air down the Muldoon shaft, entering the mine, would no doubt have prolonged the lives of the miners and would have enabled rescuers to render assistance. By placing a door, which could have been done, or a temporary brattice, at the top of the manway on the 3,900 level, the fresh air *forced* down Muldoon shaft, or drawn down by natural ventilation, would not only have supplied good air, but would have enabled the rescuers to explore the lower portion of the mine while fire was raging far above them. There would have been no necessity for oxygen helmets, for the gases would be ascending through the Argonaut shaft, caused by the intense draft created by the fire. The fan, kept running, was actually pulling the gas downward toward the miners and toward those who would assist and try to rescue the unfortunate men.

I hope and believe the testimony given by Mr. Rickard will cause managers and foremen of mines to make a study of mine ventilation and hereafter to apply the results of their investigation to proper ventilation of mines under their control.

I myself wrote the first metal-mine inspection bill ever presented to any legislature in the United States. Charles J. Christian, Senator from the Leadville district of Colorado, and Charles Bartholomew, Representative from La Platte County, Colorado, introduced the bill which I prepared in the Colorado Legislature in 1888. The bill was passed, and Governor Job A. Cooper appointed me one of the state mining inspectors. However, the opponents of the bill at the next session of the Legislature passed a mining bureau bill and had the inspection work placed under dictation of that bureau, a specimen-gathering concern managed by politicians. Now, a few years later, Montana and other western mining states are working under wise inspection laws, but many inspectors have been appointed who have not the least knowledge of the chemistry of mine gases, nor the proper methods of ventilation of mines. GEORGE KISLINGBURY.

Los Angeles, Calif.

Metallurgists of Note

ALLAN JAY CLARK

THE HOMESTAKE is a great mine, great not only because of the magnitude of its operations but also because of the calibre of the men in charge. In the front rank of those who have contributed to the success of this enterprise is Allan Jay Clark, the chief metallurgist, who has been with the company since 1897—length of service that might seem unusual were it not for the fact that the Homestake is noted for an ability to retain men on its staff longer than can most mining companies. A Veterans' League in Lead, composed of men who have been in the employ of the company for twenty-one years or more, has more than 150 members! Mr. Clark's experience and intimate contact with the milling and cyaniding of gold ores for twenty-five years has found expression in the new South Mill, designed by him to replace some of the older stamp-mill units. The planning and operation of such a mill may be compared with the work of the conductor of an orchestra, who requires every member to play his part at the proper time. Skill is no less necessary in the management of a cyanide plant, in which each machine can be expected to do only just so much efficiently. Mr. Clark is a descendent of an old New England family. He was educated at Berkeley School, New York, and at the School of Mines, Columbia University, becoming a member of the Alpha Delta Phi and graduating with the degree of Engineer of Mines in 1896. His first professional appointment was in Alabama, with the Tennessee Coal, Iron & R.R. Co. He relinquished this after a year, going to Lead, S. D., where he took charge of the assaying department of the Homestake Mining Co. His first work beyond assaying was to build a plate house, which he did uncommonly well. Then he turned his energies to the treatment of Homestake mill tailings, which, in the opinion of several metallurgists, were too low grade to be handled successfully. C. W. Merrill had been engaged by the company to solve its metallurgical problems, and Mr. Clark contributed greatly to the success of the plant that was installed. Upon the retirement of Mr. Merrill, in 1906, he succeeded him, and nine years later he assumed control of the stamp mills and other metallurgical equipment on the property. Since then he has been responsible for many notable advances in local practice and has contributed in large measure to the resultant success. His record and knowledge of the amalgamation and cyanide processes entitle him to recognition as one of the foremost gold metallurgists of the day; and it is gratifying to note that the results of Homestake progress in the treatment of gold ores have been ungrudgingly given to the profession. In 1913 he and Dr. W. J. Sharwood, his associate, were presented with the Consolidated Goldfields Medal of the Institution of Mining & Metallurgy for a paper on "The Metallurgy of the Homestake Ore" — a monumental and highly informative monograph on the subject. Mr. Clark has also contributed to the *Transactions* of the A.I.M.E. and of the Chemical, Metallurgical and Mining Society of South Africa, to *Engineering and Mining Journal, Metallurgical & Chemical Engineering,* and the *Mining Magazine.* He is State Chairman of the Naval Consulting Board, and has acted in a consulting capacity for various clients during the last few years. Mr. Clark is of the quiet and resourceful type of engineer. He is held in high esteem by his associates and colleagues, who realize that his success is traceable to a pleasing personality as well as technical proficiency and keen interest in his work. Though a comparative stranger to a recent visitor from the *Journal-Press* staff, Mr. Clark was willing to trudge through a driving snowstorm to show him the various units of the plant, which are scattered around Lead and Deadwood, and to explain the metallurgy of the ore. The highly efficient state of gold milling at the Homestake in the older, scrupulously clean and smoothly running units, as well as in the new South mill, is eloquent testimony to the man and the fruit of his efforts.

ALLAN JAY CLARK

Mr. Clark was married in 1901 to Miss Jane Parfrey, and they have three children, the oldest of whom is a student in the University of Wisconsin. He is a member of the A.I.M.E. and the Institute of Mining and Metallurgy.

An Investigation of Losses in Copper Blast-Furnace Slag—I

Study of Slags Produced at Plant of Consolidated Mining and Smelting Co., Trail, B. C., Indicates Some Errors in Work of Earlier Investigators — Pyrogallic Acid Method Developed to Determine the Amount of Oxidized Copper Present

By D. F. Stedman

TO STANDARDIZE the slag losses occurring with a blast furnace, to enable a reasonably accurate estimate to be made of the minimum operating slag loss to be expected with different slags and mattes, and to correlate the previous contradictory theories as to the chemical form of the slag losses, were the aims in the work to be described in this paper. The work may properly be classified under the following headings, although these divisions cannot be followed in detail in the discussion:

1. The condition of present slag losses.
2. Methods of analysis to determine chemical condition of slag losses—i.e., fractional determination of copper in slag.
3. The probable slag losses when smelting a charge consisting largely of copper concentrates, making a high-grade matte and low-silica slag.
4. Considerations as to the physics of these slag losses.

Previous Work Reported

The following investigations have a direct reference to the subject under discussion:

The work of F. E. Lathe[1] is based on a determination of copper silicate according to T. Kiddie's method—digestion of slag sample with 5 per cent sulphuric acid at 80 deg. C., and electrolytic determination of copper without filtering. This method is open to the following serious objections:

1. On treating slags with dilute acids, hydrogen sulphide is given off in sufficient amount to smell distinctly, during the whole decomposition, which will evidently precipitate copper.
2. Magnetite is always present to a greater or less extent, and the ferric sulphate resulting from its solution will dissolve copper sulphide from suspended particles.
3. During electrolysis, ferrous salts will be oxidized at the anode, and will dissolve copper from suspended copper sulphide.

These effects will disqualify the method entirely. Lathe also made some settling experiments on Granby and Anaconda slags, but his figures do not agree with those which I present in Fig. 1, probably because he used a lower temperature, larger quantities of slag with a smaller contact surface of matte, and a shorter time of fusion. His figures are somewhere between those given in Fig. 1 and the original composition. He also states that on charging an ore containing chrysocolla to a blast furnace the slag was invariably inordinately high in copper, and the practice was discontinued. If the blast and coke were the same, this charge would probably produce more magnetite, which would, according to a later article by C. G. Maier, increase the loss by gas flotation, making the loss indirect, and probably avoidable, but not due to the difficulty of reducing copper silicate.

In a more recent article Lathe[2] used a revised method of analysis for copper silicate. This method was originally devised by the U. S. Bureau of Mines[3] for application to ores. Although slags are of an entirely different nature from ores, the method seems to be applicable to slags (at least in the form as finally modified at Trail). The original method as given by the Bureau of Mines was: Agitation of sample with 3 per cent sulphur-dioxide solution for sufficient time to dissolve all oxidized copper minerals, filtration, and determination of copper in filtrate. The sulphur dioxide would not decompose the slag completely, so Lathe added sufficient hydrofluoric acid to accomplish this. He states that after thorough investigation he found the acid to have no effect except to insure decomposition. The experiments at Trail, however, do not agree with this. (See data presented later under chemical methods.) The results given in Table I in Lathe's article, on blast-furnace slags, should be but little affected, except where air-cooled samples were used, when the sulphur-dioxide figure will tend to be low, owing to poor decomposition, and the hydrofluoric-acid and sulphur-dioxide figures will tend to be high, owing to magnetite introduced in the sample. His copper silicate values on reverberatory slags will, I think, be decidedly high, and the converter slag values quite useless, in both instances, because of the universal presence of magnetite.

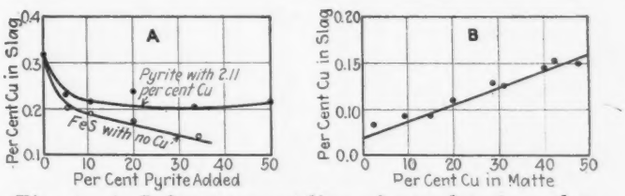

Fig. 1—A. Laboratory settling of reverberatory slag (Maier and Van Arsdale). B. Laboratory setting of Granby slag (Lathe)

The Work of Maier and Van Arsdale

C. G. Maier and G. D. Van Arsdale[4] developed a method for the determination of copper in slag, present as globules of matte, using dilute silver nitrate as a solvent, and showed that this source of metal loss was only a part of the total slag content. The difference they concluded to be copper sulphide dissolved in the slag. This was decided by consideration of the behavior of slag when fused with pyrite. When fused with increasing amounts of copper-free pyrite, the copper in the slag decreased continuously (see Fig. 1),

[1] *Engineering and Mining Journal*, Vol. 100, p. 215.

[2] *Engineering and Mining Journal*, Vol. 110, p. 1076.

[3] *Engineering and Mining Journal*, Vol. 105, p. 552.

[4] *Engineering and Mining Journal*, Vol. 107, p. 815.

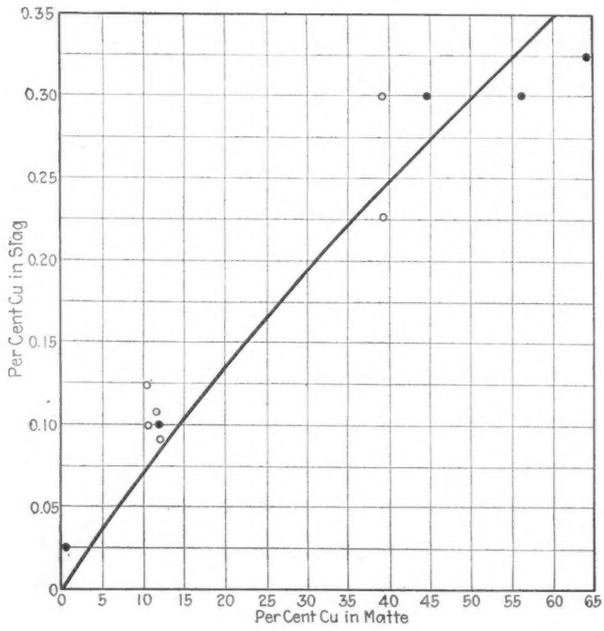

Fig. 2—Copper loss as "dissolved sulphide" in Trail blast-furnace slag

while with pyrite "saturated with copper sulphide" (2.11 per cent copper), the slag quickly became constant, still containing the copper of the original slag not present as prills. This appeared to show that the pyrite, being already saturated with copper sulphide, only washes out prills of matte. Messrs. Maier and Van Arsdale base their statement "saturated with copper sulphide" on the amount of copper retained by the ferrous sulphide constituent of matte when solidified, but ferrous sulphide could certainly not be considered as saturated with copper sulphide by 2.11 per cent copper, when molten. These results will be referred to later.

In a later article the same authors[5] discuss the action taking place on adding converter slag to a reverberatory furnace, and show that for any particular slag the prill loss varies directly with its ferric iron content, but the dissolved loss is constant, and this would hardly occur if the dissolved loss were oxide, as the ferric iron and copper oxide, both being products of oxidation, should vary together.

In Stansfield's "Electric Furnace," page 341, reference is made to a small electric furnace smelting about fifty tons per day, making a matte of 47 per cent copper, and a slag of only 0.10 per cent copper, disregarding that the slag approached converter slag in composition. This may have been owing to electrolytic action of some kind, or to the carbon electrodes, as this is much lower than the experiments here related indicate as possible with blast-furnace conditions. (See Fig. 2.)

B. Dudley[6] shows quite accurately that the ordinary laws of solubility hold at high temperatures; the work is not on copper slags and mattes, but on the analogous distribution of silver between lead buttons and assay slags. The relations he found were (see Fig. 3):

1. That for a given slag, the silver in the slag is directly proportional to its concentration in the lead button.

2. The silver loss increases rapidly with temperature, in a uniform manner. On applying the physico-chemical conceptions to this solution and calculating the heat of solution of the silver, it is found to be constant, within the experimental error, for all temperatures and slag compositions used. Temperatures varied from 780 to 1,170 deg. C., and slags varied widely, from 8 to 65 per cent lead oxide, being slags commonly used for different purposes in assaying.

3. The silver loss is directly proportional to the lead oxide in the slag, even when carried so far as scorification slags and the lead oxide absorbed in cupellation.

4. That whenever a concentration is at all high, the molecular concentration must always be used instead of weight concentration, if accurate comparison is desired.

Experimental Work on Trail Slags

The following work is almost entirely with reference to blast-furnace slags produced at the Trail, B. C., plant of the Consolidated Mining & Smelting Co., or slags produced under similar conditions, probably including most blast-furnace slags, but not reverberatory slags.

Operating data from 1903 to 1919 were generalized to obtain average operating slag losses as a basis of consideration, as daily and even monthly figures are variable.

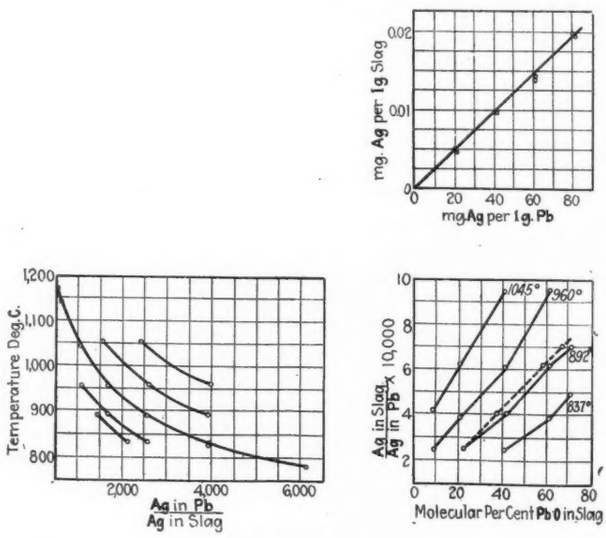

Fig. 3—Distribution of silver between lead and assay slags (Dudley)

On taking the average slag and matte assays for each year, it was seen that the ratio slag gold:matte gold is almost constant, at about 0.3 per cent or a little higher. The copper, however, does not show this, and although the ratio slag copper:matte copper decreases as the matte grade increases, on plotting the figures no uniformity is evident. This persistent irregularity seemed to show an incorrect method of averaging, so the monthly slag and matte assays were arbitrarily divided into groups:mattes 5 to 10 per cent copper, 10 to 15 per cent copper, and so on, with their corresponding slags. On averaging these groups, points were found on an extremely smooth curve. (See Fig. 4.)

As it is impossible to produce this type of curve accurately, equations were found to represent it as closely as possible, according to the form slag copper = (matte copper)^x, introducing suitable constants. The most

[5] *Metallurgical and Chemical Engineering*, Vol. 22, p. 1101.
[6] *Metallurgical and Chemical Engineering*, Vol. 14, p. 636.

suitable equation using integral powers is the following:

$$S = \frac{M^3 \times 0.7}{100{,}000} + 0.135 \text{ per cent where}$$

S = slag copper, and
M = matte copper.

This equation has no metallurgical significance, but merely represents the losses that actually occurred in the past.

This plot, if produced, would probably give too high a loss, as a number of other plants have published their average losses, almost all of which show a flattening between 25 and 30 per cent copper in the matte, amounting to about 0.07 or 0.08 per cent of copper in the slag.

Although this plot represents well the slag loss at Trail, it is not quite what it was intended to be—a plot of standard operating slag loss for low-grade mattes which might be extrapolated to higher-grade mattes—for several reasons. The method of averaging changes the curvature considerably, increasing it in the low grades but decreasing it in the high grades, possibly changing a second to a third power graph; at any rate, making the slag loss increase more rapidly than it should. Also, the low-grade figures represent many years of regular running, with a slag of about 12 per cent iron and 20 per cent lime, and the slag copper reduced to the absolute minimum under these conditions; whereas the higher grades represent much less regular running for the last few years only, with a slag of 22 per cent iron and 12 per cent lime, the loss probably being reducible if the conditions were steady long enough. As these effects all tend in the same direction, the plot will be of little use for its original purpose.

In an attempt to obtain a relation between slag composition and copper loss, the operators at Trail took the years' average figures from 1910 to 1914, inclusive,

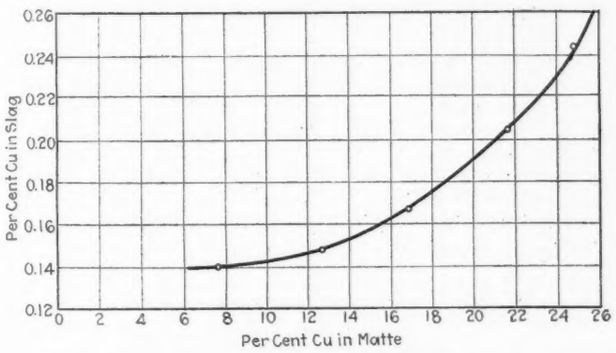

Fig. 4—Generalization of operating data. Average copper loss in slag

introduced constants k_1 k_2, etc., and solved for the value of those constants:

$$(k_1 \times \text{SiO}_2) + (k_2 \times \text{CaO}) + \text{etc.} = \frac{\text{Slag Cu}}{\text{Matte Cu}}$$

These constants, when tried on other slag analyses (years' averages) were of practically no value, although they were in the right direction—e.g., 12.0 for iron and —1.5 for lime ($\times$ matte grade $\div$ 70,000), showing that as iron replaces lime the slag carries more copper; but the constants seemed to give too small a variation. This work was not carried out so completely as might be desired, owing to the amount of work necessary to solve large determinants. A different form of equation would have been much better, taking some slag analysis with its corresponding slag and matte copper from the operating plot as a standard, and equating the variation above or below this as before:

$$S = M\left[\left(k_1 \times (SiO_2 - c_1)\right) + \left(k_2 \times (CaO - c_2)\right) + etc. + \frac{s}{m}\right]$$

where S and M are slag and matte copper with slag "SiO_2", "CaO", etc., and s and m are slag and matte copper in the standard slag of $SiO_2 = c_1$, $CaO = c_2$, etc. As long as the slags do not vary too much, this equation should be reasonably correct.

On averaging the golds in the same manner as the coppers—matte assays averaged under groups 1 to 2 oz., 2 to 3 oz., etc., with their corresponding slags—the results plotted in Fig. 5 were obtained, quite nearly a straight line through (O, O), checking the previous conclusion that slag gold is directly proportional to (0.34 per cent of) matte gold. This seems to point to a single type of loss; for if the loss were divided, as is true with the copper, between prill and dissolved loss, the plot should be of the same general type.

Methods of Analysis

The following methods of analysis were studied with the purpose of determining the condition of copper losses in the slag:

Treatment of slag with 1 per cent silver-nitrate solution, to dissolve the copper present as matte prills, and leave all other copper unattacked. This method was developed by Maier and Van Arsdale, but Lathe, in his later article, rejected the process entirely. At first, the results obtained were of no use whatever, and it was practically abandoned, the conclusion being that the process merely involved a matter of time (and temperature) to obtain all of the copper in solution. As a final check 10 g. of blast-furnace slag was fused with 0.5 g. per cent of cuprous oxide. A small button of metallic copper separated, owing to the action of cuprous oxide and cuprous sulphide, but a large part dissolved. The bottom part of the slag was then chilled, the crucible was replaced in the furnace and the remainder was allowed to crystallize completely. The slag was then polished and etched with silver-nitrate solution. The chilled portion was not attacked at all in thirty minutes (no silver precipitated on surface indicates that no copper was dissolved from the slag), but the gray constituent of the crystallized slag was attacked distinctly in a few minutes. This would explain the erratic behavior of the reagent before, as some of the slags were partly or

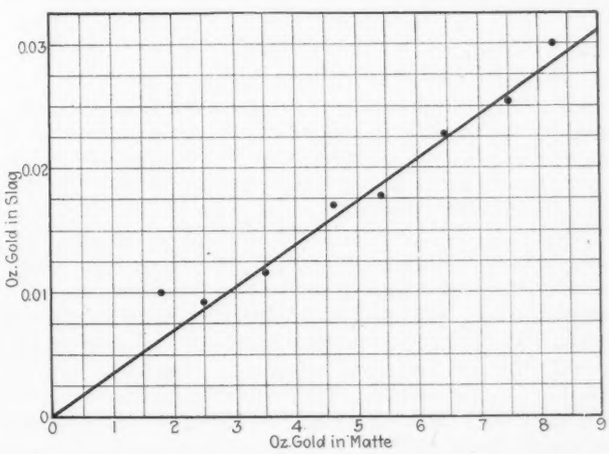

Fig. 5—Generalization of operating data. Relation of gold in matte to gold in slag

entirely crystallized. After this, crystallized slags were avoided as much as possible and a shorter treatment was given when they were unavoidably used (overnight instead of twenty-four hours), but the figure obtained for prill loss will probably be too high even then. On chilled samples this method gave complete satisfaction, although this reagent dissolves a small amount of copper even when prills are known to be absent, presumably from the surface of the particles. This amount (up to about 0.01 per cent) is usually negligible. Grinding in porcelain as suggested makes a much cleaner separation, but is not absolutely necessary, as long as enough silver nitrate is used to dissolve iron introduced in crushing, often several times that necessary for solution of the prills.

The method of analysis for copper on slag samples was: Take 1 to 5 g. sample and add about 1 c.c. water, 10 c.c. HNO_3, and 2 to 3 c.c. HF (very carefully if sample is chilled). Put on warm plate till action ceases, add 10 c.c. slightly diluted H_2SO_4, and evaporate to fumes, fuming strongly ten minutes. Cool and dilute to 50 c.c., boil ten minutes, and filter. Precipitate copper on small pieces c.p. aluminum ($\frac{1}{4}$ x $\frac{1}{10}$ in.). Boil till iron is completely reduced, to prevent re-solution of copper. Filter, dissolve through filter with 1:1 HNO_3, wash once with acid and twice with a little hot water, evaporate to about 3 c.c., add a few drops of water and excess 1:1 NH_4OH, filter through small cotton-wool plug, boil to about 10 c.c., add one drop dilute NH_4OH, and slight excess acetic acid; cool completely, add about 1 c.c. 50 per cent KI, and titrate with $Na_2S_2O_3$ solution (approximately 1 c.c. = 2 mg. Cu), adding 5 c.c. weak starch solution when the iodine color is light yellow. With mattes the procedure is: Weigh sample (20 to 40 mg. Cu) and add 5 to 10 c.c. HNO_3 and 1 c.c. HCl. Boil till completely dissolved; add 5 c.c. of slightly diluted H_2SO_4, and evaporate to fumes, and so on as for slags. This method checks well with precipitation as sulphide and ignition to oxide, and interfering metals (such as bismuth) appear to be practically absent.

Dissolving copper silicate, leaving copper sulphides unattacked. Kiddie's dilute sulphuric-acid method for "oxide copper" was mentioned previously. The use of this method disqualifies Mr. Lathe's first article entirely. This method could not be applied to any material unless soluble sulphides and oxidizing minerals (e.g., Fe_3O_4) are absent, which certainly rules out all metallurgical slags.

U. S. Bureau of Mines sulphurous-acid method, as modified by Lathe. This method consists of agitation of the sample in a stoppered bottle with 100 c.c. of freshly made 3 per cent sulphur-dioxide solution, according to the original method, with 10 c.c. hydrofluoric acid added. According to Lathe, this acid has no effect except to decompose the slag. On testing this it was found that both addition of magnetite and artificial copper sulphide increased the amount of copper dissolved considerably, and that the figure on slag alone was much higher than when pure sulphur dioxide only was used, on a sample ground fine enough to be decomposed. The addition of copper sulphide probably affects it only through the small amount of magnetite already present in the sample. This effect is probably due to the fact that ferric fluoride is practically non-ionized, so that sulphur dioxide is not a strong enough reducing agent to remove it as fast as it is formed. On looking for a stronger reducing agent, such metallic compounds as chromous chloride were rejected, owing to uncertainty as to the entire effect. Pyrogallic acid was then thought of. This is quite an active reducing agent, and the possible points in favor of it are:

It is a very weak acid, so that only a small part of the ferric iron will combine with it.

The products of oxidation, being organic, will probably be very inactive in dilute water solution.

With it there is no chance of forming metallic copper, as there is with such reducing agents as zinc dust dissolved in sulphur dioxide.

On trying out this reducing agent—1 g. pyro, 150 c.c. fresh sulphur-dioxide solution, and 5 c.c hydofluroic acid, the results were remarkably concordant, even on adding 40 mg. magnetite or 2.5 mg. cuprous sulphide to a 1-g. sample. This was tested as thoroughly as possible in the time available, and results all check, although they are still rather higher than when pure sulphur dioxide is used on a sample fine enough to decompose (about 0.01 per cent too high on a sample of total copper 0.135 per cent—i.e., about 8 per cent of the copper sulphide dissolves). It will probably be more accurate to apply this approximate correction than to assume complete insolubility of cuprous sulphide, so this has been done in all results reported, except, of course, in the results obtained on testing the method.

Accuracy of Method Proved

The following experiments were made to test the accuracy of the method:

Magnetite used in tests isolated from converter slag, (Cu = 0.35 per cent).

Copper sulphide used in tests artificial.

TEST ON COMMERCIAL SULPHUR-DIOXIDE SOLUTION
(containing some H_2SO_4)

(1) 10 mg. Cu_2S + 150 c.c. SO_2 (commercial solution diluted with an equal volume of water).....Dissolved 0.05 mg. Cu
(2) Same as (1) + 3 c.c. HF.....Dissolved 0.01 mg. Cu
(3) Same as (1) + 20 mg. Fe_3O_4.....Dissolved 2 mg. Cu
(4) Same as (1) + 20 mg. Fe_3O_4 and 3 c.c. HF Dissolved 4 mg. Cu

These experiments were left twenty-four hours to exaggerate any solvent action of the reagents. They show that Cu_2S is not soluble to any appreciable extent in SO_2, even when not fresh, and in the presence of HF, but the presence of magnetite causes solution of copper, and still more so in the presence of HF, so that all further experiments were made with pure SO_2 solution, (from copper and H_2SO_4).

(5) 2 g. high-grade slag made experimentally + 40 mg. Fe_3O_4 and 150 c.c. fresh SO_2 solution.....Dissolved 0.025 mg. Cu
(6) Same as (5) but without magnetite—Dissolved 0.025 mg. Cu

I.e., with pure SO_2, addition of magnetite does not affect the result.

Experiments 7 to 15 inclusive were made on a representative plant slag, used later for fusions; total Cu, 0.135 per cent.

(7) This slag, on treatment with 3 per cent SO_2, by the original method, on an extremely fine sample, (all minus 1/800 in., most minus 1/1500 in.) but requiring 5 hours for decomposition, gave a value of 0.007 per cent Cu as silicate. (Microscopic examination of residue showed complete decomposition.)

This method is satisfactory from a chemical standpoint, but as it required two hours grinding on a 1-g. sample, it could hardly be used regularly.

TEST ON ADDITION OF HF

(8) 1 g. slag (about —200 mesh) + 150 c.c. SO_2 solution and 5 c.c. HF .....Dissolved 0.035 per cent HF
(9) 1 g. slag + 40 mg. Fe_3O_4, 150 c.c. SO_2, and 5 c.c. HF. Dissolved 0.09 per cent Cu
(10) 1 g. slag + 2.5 mg. Cu_2S, 150 c.c. SO_2, and 1 c.c HF Dissolved 0.04 per cent Cu

[Should check with (8), but sample much finer and less HF used, so Cu_2S probably slightly attacked.]

No. 7 is probably the most accurate result; (8) shows the effect of HF, probably through the magnetite already in sample; (9) shows the effect of adding 40 mg. of magnetite with HF present; (10) shows the effect of copper sulphide with HF present. According to these results, Mr. Lathe's figures on reverberatory and converter slags will be very high.

TEST ON ADDITION OF PYROGALLIC ACID

(11) 1 g. slag + 1 g. pyro, 150 c.c. SO_2 and 5 c.c. HF..... Dissolved 0.02 per cent Cu
(12) Same as (11) + 40 mg. Fe_3O_4..Dissolved 0.02 per cent Cu
(13) Same as (11) + 2.5 mg. Cu_2S...Dissolved 0.02 per cent Cu

These check absolutely, although they are rather higher than the standard, (7).

(14) Same as (11) but rather coarser, 80 to 100 mesh, and let stand about one-half hour before and after agitation..... Dissolved 0.03 per cent Cu
(15) Same as (11) but finer, and used continuous agitation.... Dissolved 0.012 per cent Cu

Very near check to standard, 0.007 per cent, showing that continuous agitation and fine grinding are necessary.

Experiments (11), (12), and (13) were repeated on other slags, with exactly similar results, neither addition of magnetite nor copper sulphide affecting the result.

The final method adopted was: Sample ground in agate mortar till no black slag particles are visible, and slag has only slight gritty feel—about ten minutes on a 1-g. sample is sufficient. Screening through brass screens is not permissible, and sample is weighed out as ground. A clean, glass-stoppered reagent bottle is taken and a short-stemmed funnel inserted, 1 g. pyrogallic acid weighed into funnel, and 1- to 2-g. slag sample added to top of pyro, getting as little as possible on glass. This is washed into bottle with about 150 c.c. fresh 3 per cent SO_2 solution and 5 to 8 c.c. HF added. The SO_2 solution should be made every few days, and kept in a dark bottle. The bottle is stoppered tightly and rolled in a machine till decomposition is complete, one and one-half to three hours. Solution is filtered as quickly as possible through a Gooch crucible, decanting off as much of clear solution as possible, always keeping the crucible at least half full and covered as much as possible. Wash out bottle with 10 c.c. SO_2 solution and add to crucible (before it is empty, to prevent oxidation). Add 15 to 20 c c. HNO_3 and 10 c.c. H_2SO_4, evaporate to fumes, and so on as in copper analysis previously given, down to the addition of excess NH_4OH and filtration. If blue color indicates less than about 0.5 mg. Cu, colorimetric ferrocyanide estimation is better than titration; otherwise the iodide method can be followed.

With reference to screening, on grinding a sample to all through 100 mesh, and then to all through 200 mesh, the slag picked up 0.03 per cent copper. This is a considerable amount compared with the original 0.17 per cent, and in all work screening was entirely avoided.

To be concluded

The Singkep Mines—Exports from Java

The Singkep Tin Co. of the Dutch East Indies received its concession from the government in 1889. Besides the ore found on the island, important deposits were discovered under the sea close to the land. These deposits are worked with dredges, the mud being put through a preliminary concentration aboard and then further concentrated on shore. All of the Singkep production is smelted at Singapore. Production in 1913 amounted to 672 metric tons, in 1917 to 770 tons, in 1918 to 514 tons, in 1919 to 717 tons, and in 1920 to 608 tons, according to *The Far Eastern Review.*

Exports of tin from the island of Java (in metric tons) during the past three years were as follows:

Countries of destination	1919 Tons	1920 Tons	1921 Tons
Netherlands	7,032	7,029	5,152
Great Britain	2,570	4,205	6,378
Germany	.....	14	387
France	415	105	303
Japan	880	695	1,177
All other	5,355	1,600	142
Totals	16,252	13,648	13,539

Marketing Brass and Copper Products

Frequent editorial comments have been made in these columns during the last year or two on the unsatisfactory way that copper and brass articles are marketed in the retail stores of this country. In this connection the views of an Englishman interested in the hardware trade, who recently visited the United States and Canada, are of interest. They are thus reported in *The Ironmonger,* in part:

"I may say at once I do not think we have anything to learn from either Canada or the United States in the design or finish of goods, either in copper, brass, or tin. On the contrary, they have much to learn from the Old Country. . . . There were no brass or copper goods, either hammered, repoussé, or engraved, to be seen in either country. There were, however, a few embossed kettles. The largest fancy tea trays were 16 in. long, neither in brass nor copper, but the usual German rubbish, electro-coppered. The only brass or copper goods that interested me were some very pretty cake plates and stands, pierced. Their chafing dishes, almost solely an American production, were also very good, yet they have never found favor in England. Their jardinières were simply plain stampings of very thin metal, and were of the crudest designs. One 8 in. in diameter could be held in the palm and blown to nearly the other side of the showroom. The enamel utensils were splendid, and the quantity on show at many of the stores was colossal.

BEDSTEADS AND CUTLERY BELOW STANDARD

"In all cases bedsteads were in black and brass, and all brass; and here I consider the British manufacturer has more than a sporting chance of doing a very large trade. I do not say this solely from what I saw in various showrooms, because similar ones were to be seen in all the palatial hotels in both Canada and the United States. These bedsteads were quite crude in design; there was not the slightest attempt made to please the eye, not even in the most expensive brass ones.

"The knives invariably used are atrocities. Steel knives are seldom seen, and everywhere knives are supplied with handles and blades either nickeled or silver plated, fit only for cutting butter. If one happened to have a chop or steak in a restaurant and asked for a steel knife, it was forthcoming, but even then it had to be examined carefully to make sure which was the business edge. There was little risk of personal injury either way.

"At every store I visited I was given the fullest information and treated with the greatest courtesy. I could not have received more attention had I been wishing to purchase the businesses. This attitude was most noticeable at Marshall Field's, of Chicago, and Wanamaker's, of New York. At both of these world-famous houses I spent several hours, and I shall never forget the kindness of the managers. I told both these gentlemen that I was very disappointed, because I hoped to learn a great deal, instead of which I considered that they were fifty years behind the Old Country in variety, design, and finish of nearly all the fancy brass, copper, and tin goods that I had seen throughout the United States—electrical fittings and chafing dishes alone excepted. . . .

"In both countries their stations and hotels represent the last word in luxury. The same thing cannot be said of their stores, of which the walls are bare in appearance, the fixtures poor, and the goods too crowded and not shown to the best advantage. I suggested to several of the principal buyers that if they went to London they should pay a visit to Harrods, where they would find out what 'shopping in luxury' meant."

The writer says further that an opportunity would seem to be offered on this side the Atlantic for the sale of brass fireplace requisites, such as fenders, fire tongs and shovels. Most people who have fireplaces, he found, use the kitchen poker and take a chance on sparks.

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The Borda Garden at Cuernavaca, Mexico

Mining Camps of North America

Huantla, State of Morelos, Mexico

An Old Camp South of Mexico City—Worked First by Spaniards—Revived in the 'Eighties—Four Old Mills Were Erected—Much Good Ore Doubtless Remains Below Water Level

By Robert B. Brinsmade

PERHAPS the first silver belt worked by the Spaniards after the Conquest was that running from Temascaltepec, in the western part of the State of Mexico, in a southeasterly direction as far as Huantla, in the southern part of the State of Morelos. Of the silver mining camps in the latter state, Huantla has been the only important producer, and it is far from exhausted, despite an activity of three centuries and its present aspect of a deserted village.

The State of Morelos can be reached from Mexico City by two railways: a broad-gage branch of the Nacional system passing through Cuernavaca and terminating at the Rio Balsas, in the State of Guerrero; and a narrow-gage branch of the Interoceanic system, which, after reaching Cuantla, in the east central part of the state, forks southwestward to join the Nacional system at Puente de Ixtla and southeastward to reach the city of Matamoras, in Puebla. The Nacional branch leaves the valley of Mexico, by crossing the high mountain barrier to the south at a height of 10,000 ft., and descends into the plateau of Morelos, which slopes southward from an altitude of 5,200 ft. at Cuernavaca to 3,000 ft. at Jojutla.

Though Morelos has been reconciled with the Federal government since the fall of Carranza, in May, 1920, the effects of eight years of guerrilla warfare cannot be erased in two years. Cuernavaca, the capital, once the fashionable winter resort for Mexico City, has suffered the usual loss of its railway station by fire, but most of its other buildings are still intact, as is also the famous garden built by Juan Borda, the bonanza miner of the eighteenth century. The state's greatest industrial loss is due to the burning of its eighteen white-sugar refineries, each of which represented an investment of $500,000 or more. Not only are the refineries ruined, but all their contributing cane fields—which were planted on irrigated land because of the dry winter climate—have disappeared because they have been neglected for eight years and are now being cultivated as rice paddies by the local peons, among whom a large portion of the former great estates has been apportioned by the state authorities.

To reach Huantla one now starts from Jojutla, which is only 45 km. away, or 20 km. less distant than Cuantla, the former outfitting railway city. But the ancient wagon road from Cuantla, over which all the heavy mining machinery in the camp has been hauled, is now impassable, because of decayed bridges and numerous washouts consequent upon a decade of neglect, so that the shorter mule path from Jojutla is preferable for

the visitor, despite its dearth of bridges and its steep hills. Morelos is blessed with abundant semitropical pastures, and before the revolution the region abounded in livestock, but now meat and milk, like sugar, are dearer than in Mexico City. As for horses, the few survivors are of a wretched type, as I found to my cost when my mount fell down beneath me while crossing the Cuantla River, halfway between Jojutla and Huantla.

Climate of Huantla Equable

Nothing is more surprising in Mexico than the abrupt changes in topography and climate within a small geographic area, and a greater contrast than the cold gray desert around Pachuca and the green hill-pastures of Huantla could hardly be imagined. The latter town lies at an altitude 5,000 ft. lower than the former, and during my visit in July had a temperature varying from 70 deg. at night to 85 deg. at midday in the shade. Its houses are grouped along a small valley rather than a gulch, and are constructed with walls of stone or adobe and roofs of red tile, baked from the local clay. Unfortunately, most of the roofs have disappeared, as they were destroyed in 1913 when the town was sacked by the troops of Victoriano Huerta. Though this sinister president was sustained by the great land owners, and was therefore supposed to be the special guardian of property rights, it is doubtful if any of the revolutionists that fought during or since his time committed more vandalism than his army. In the operations at Huantla not only were private homes destroyed but also three out of four reduction mills for silver ore. Curiously enough, the biggest of these ruined mills belonged to Inigo Noriega, who was a zealous partisan of the Huerta regime.

Surface Is Principally Andesite

The geology of Huantla is simple. It lies on an extensive andesite batholith which burst through the sediments in the Tertiary, and its subsequent erosion has produced the rounded hills of the surrounding topography. Earth movements during the cooling of the batholith formed the numerous fissures of the district, whose subsequent filling by the siliceous solutions of expiring vulcanism created the quartz veins of the camp. Though there are a multitude of veins, only a few appear to have been important producers if one may judge from the size of the old stopes. The "Mother" lode is evidently the Tlalchichilpa, which has been stoped at intervals for 4 km. from the Tlalchichilpa mine on the west to the Peregrina on the east, and has a strike of N. 80 deg. E. and a dip of 70 deg. to the south. The most active mineralization was at its west and highest end, for the oreshoots diminish in length and frequency as one recedes from the western outcrop, at 4,200 ft. elevation, to the eastern, about 600 ft. lower.

Unlike Pachuca, where much of the surface is covered with flows of recent barren rhyolite, Huantla exhibits everywhere the naked surface of the mineral-bearing andesite, a rock of a grayish-green matrix which weathers a reddish brown and shows numerous inclusions of a white plagioclase feldspar. Though the fissure veins are continuous for a long distance, they seldom exhibit slickensided walls, and quite often one of the walls is ill-defined. Neither is the fissure filling uniform, for much of it consists of fragments of the andesite walls, cemented by vein-quartz of a white, red, or green color. The oreshoots occur at the intersection of cross fissures with the main vein and are doubtless due to the precipitation of the metals by the intermingling of two streams of solutions which met at these favorable points. They vary in length from more than 100 m. on the west end of the Mother lode, to a few meters on the east end of this lode and on the lesser veins; and in thickness range from 1 to 3 m.

The ore minerals are not uniformly distributed in the quartz of an oreshoot, but follow veinlets within it, parallel to the walls. The chief minerals are bornite, tetrahedrite, magnetite, galena and argentite below, with their oxidized equivalents above. The ores of Huantla, like those of the same belt in the State of Mexico, are noted for their richness in silver, 10 kg. per ton having been often attained by sorting, and 60 to 80 kg. was occasionally reached in the Santa Ana mine, even as late as twenty years ago. The gold content is small, being usually 0.3 per cent of the silver by weight. Though the richer ores appear to be due to secondary enrichment, the unaltered sulphide ores near water level are of fair grade, as evidenced by two samples cut from the 30-cm. pay streak of the San Francisco oreshoot. The first, from the roof of the lower adit, had a content of 850 g. silver and 16.6 per cent lead, and the second, from a pillar 40 ft. above, returned 530 g. silver and 15.0 per cent lead.

Mines First Worked by Spaniards

Though much of the early history of Huantla is shrouded in obscurity, it seems certain that those indefatigable prospectors and miners, the Spaniards of colonial days, were responsible for the discovery and stoping of its numerous mines. In fact, they seem to have worked so actively that they exhausted the oreshoots down to water level before the War of Independence. During the early nineteenth century, the mines were mostly inactive and were not revived till the railroad building of the '80s made it practicable to import steam hoists and pumps and heavy milling machinery and to exploit the bonanza found in the Tlalchichilpa mine in 1889.

Even after the collapse of the price of silver in 1893, Huantla continued to boom, if we may judge from the observations of a Mexican engineer who visited the camp in 1895.[1] There were then four companies in operation: the Tlalchichilpa was working its mine and mill of the same name; the Huantla-Santa Ana was installing a steam hoist on its Santa Ana mine and running its Guadalupe mill; the Restauradora had finished its modern mill and was just starting the San Francisco lower adit; and the Reforma was sinking its new shaft and was planning a new mill. Contemplating these activities impelled the visitor to predict for Huantla an outlook as bright as that possessed by Zacateceas, Guanajuato, or Pachuca.

No Mining Below Water Level

But the hopes of this prophetic engineer were never realized, and Huantla experienced a great decline in productivity even before it was overwhelmed by the flames of the Revolution. The Reforma company shut down, after it had sunk its shaft for 100 m. without finding ore, and never built its projected mill. The Restauradora company found its new mill unsuitable to its ore, and shut it down, but persevered for several

[1] "El Mineral de Huantla," *in El Minero Mexicano*, Vol. 27 (1895), No. 12.

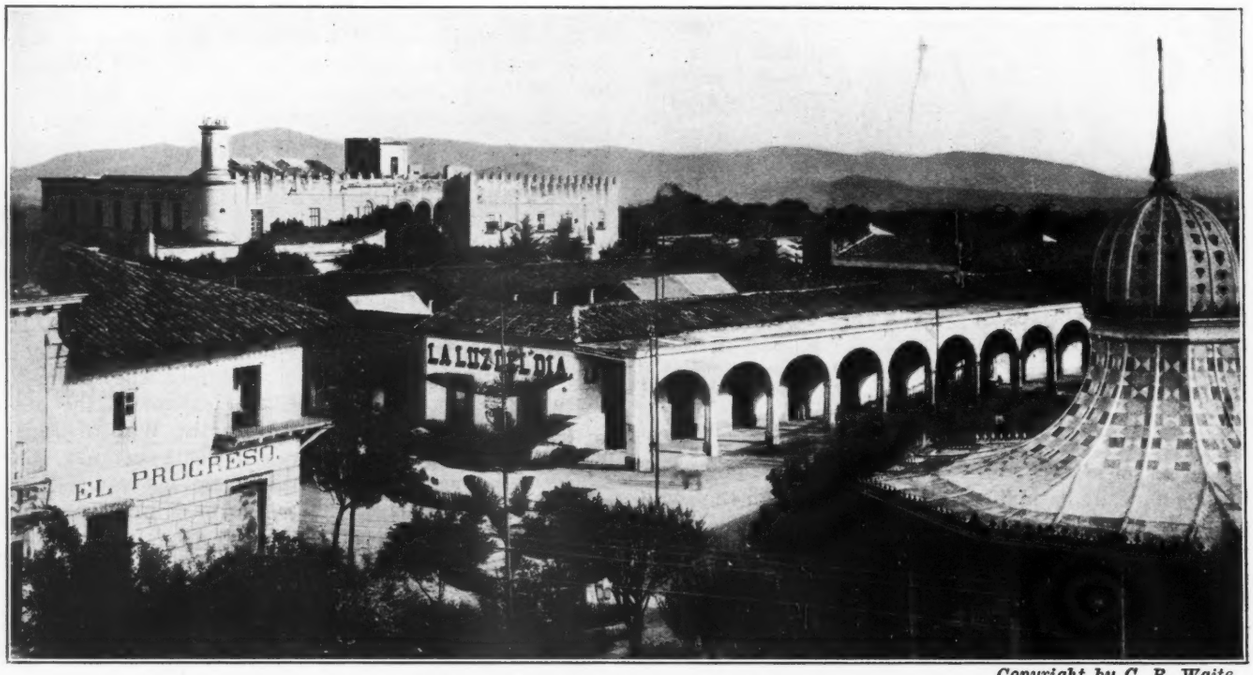
years on its adit and reached a point 250 m. from its mouth. The Huantla-Santa Ana company also shut down in 1906, when it struck a heavy water flow in the bottom; little milling ore had been developed and the expense of draining the mine by baling through an irregular inclined shaft 22 m. deep was prohibitive. About 1903 the Tlalchichilpa company closed its mill and Tlalchichilpa mine, evidently because of the poor yield of the former, when treating sulphide ores, and the expense of pumping from the latter at depth by bailing. Some years before the shutdown, the Tlalchichilpa mill is reported to have had an output of three mule loads of silver bullion a week, which might mean anything from 600 to 900 lb. Between 1903 and 1910, the Tlalchichilpa company limited itself to the development in depth of its old Santiago mine and the shipment to the Aguascalientes smelter of the resulting richer ore.

into the Mother lode. An old drainage adit enters the vein at the gulch level and proceeds eastward for 150 m. without reaching a point far enough east to drain the old workings above. The Tlalchichilpa company installed a pump at the collar of the Peregrina shaft in 1910, but was obliged by the Revolution to suspend pumping before reaching the old sump.

San Francisco mine—The old stope on this oreshoot reached the level of Huantla Creek, as was demonstrated when it was cut by the adit driven west along the vein from the gulch by the Restauradora company. This stope is 30 m. long by 1½ to 2 m. thick, and shows no ore remaining above the adit level except in a few pillars left to support the hanging wall.

Campaña mine—The surface works at this shaft are missing and the surface is caved.

Santa Ana mine—Here the only thing accessible below ground is an ancient stope west of the shaft. The



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Palace of Cortez at Cuernavaca, Mexico

The large dumps of sulphide ore remaining from the many years of development work at the San Francisco adit and Santiago mine enabled General Emiliano Zapata, in 1915, to become a successful smelter. Having built a small blast furnace at his military headquarters of Tlaltizapan (10 km. north of Jojutla), he took thither on mule-back these Huantla dumps, along with other ore dumps from Puente de Ixtla, Taxco, and neighboring points in Guerrero. With the resulting silver bullion, he coined the famous Zapata pesos, with which he shamed the Carranzistas, who were then in the midst of their orgy of fraudulent paper money.

Enumeration of Existing Mines

The famous antiguas of Huantla are said to be the following mines: Peregrina, San Francisco, Campaña, Santa Ana, and Tlalchichilpa—all on the Mother lode—and the Santiago, San Estevan, and Pajaro Verde—all on a parallel vein to the north.

Peregrina mine—This lies on a hill to the east of Huantla Creek, which has cut a groove, 350 m. deep, surface plant has been wrecked, but shows the remnants of a double-drum steam hoist, a 6 x 16-ft. return-tubular boiler, and a 7 x 9-in. Dodge crusher.

Tlalchichilpa mine—This property has been operated in modern times from a three-compartment vertical shaft, whose hoisting engine is situated at a point 500 m. inside the mouth of a drainage adit driven along the vein at the level of the upper floor of the mill. This hoist has two sheaves, with ⅜ x 2½-in. flat ropes, which are geared to duplex, 12 x 24-in. horizontal steam engines of Fraser and Chalmers make. Steam is supplied from three horizontal return-tubular boilers, each 4 ft. diameter by 14 ft. long, whose smokestack passes up the shaft to the surface, 50 m. above, and there enters a brick chimney for discharge into the atmosphere. The ancient stopes can be followed for several hundred meters to the west of the hoist, and must have produced a large quantity of ore.

San Estevan and Pajaro Verde mines—These workings are connected and occupy a long oreshoot on a parallel vein about half a kilometer north of the west

end of the Mother lode. The San Estevan company has developed the outcrop of this oreshoot by a shaft and drained it in depth by the San Estevan adit. The lowest workings are entered by the Pajaro Verde adit, which is situated farther east, 200 m. below the outcrop, and is over 300 m. long. This group has been practically idle for twenty-five years, and the present owners have done nothing beyond the extraction of a little ore left by the ancients in the old stopes, which are extensive.

Santiago mine—This is an antigua, down the gulch, a kilometer west from the San Estevan mine; it was developed considerably by the Tlalchichilpa company between 1903 and 1910, so that it now has the best showing of good ore of the district. The ancient stopes can be entered by an adit at an elevation of 3,390 ft., which follows a branch vein until it intersects the main vein at a point 200 m. from the mouth. The latter vein strikes 80 deg. east, dips 80 deg. south, and is stoped to the outcrop for 150 m. in each direction from the intersection. The stopes average 1.5 m. in width and show a well-defined foot wall but an irregular hanging wall. The recent development comprises a winze on the vein, to a depth of 125 m. below the adit, which is connected by drifts with a vertical shaft sunk at the mouth of the adit. This shaft is 330 x 220 cm. in cross-section and is lined with masonry down to water level, which is 10 m. below the collar. It is equipped with a single-drum hoist and two pumps, which were supplied with steam by two horizontal water-tube boilers whose upper drums are 450 cm. long by 75 cm. in diameter. Adjoining the shaft are extensive dumps of the ore resulting from development. This was broken by a 7 x 10 in. Blake crusher and sorted by the company for a product rich enough to ship to the Aguascalientes smelter. Later, in 1915, these dumps were sorted by the villagers a second time, for shipment to Zapata, at Tlaltizapan, so that only third-class ore now remains in them.

Smaller mines — Besides the great mines just described there are a multitude of lesser antiguas which dot the hills around Huantla in all directions. As few of these have been prospected even in modern times, their grade and productive capabilities are almost unknown. Among them are La America, Los Animas, El Pilar, La Plomosa, Los Bationes, El Salvador, San Jose, Santa Tomas, and Guadalupe.

Four Old Reduction Works Are in Ruins

The ancient mills in Huantla were called Los Angeles, San Antonio, La Palma, and Guadalupe; at Ixtaluca, on the Rio de Cuantla, 20 km. northwest, was a lead smelter.[2] The last was situated so far away in order to utilize a permanent water supply instead of the intermittent Huantla Creek, and to be near the limestone hill where flux was obtainable. Of the local mills only the last two still remain, along with two modern mills, the Tlalchichilpa and the Restauradora. All except the last are in ruins owing to the vandalism of the Revolution.

La Palma mill—This mill lies at an elevation of 3,460 ft. and belongs to E. S. Cortina, the owner of the San Estevan mine. It contains ten stamps, four stone amalgamating pans, a 4 x 16-ft. return-tubular boiler, and a steam engine.

[2]"Views of an old smelter in State of Morelos," by C. W. Pritchett. *Trans.* A.I.M.E., 1902.

Guadalupe mill—This plant comprises twenty stamps turned by a 12 x 20-in. horizontal engine supplied wiht steam by two 4 x 16-ft. return-tubular boilers. Amalgamation was conducted partly in stone pans and partly in patios, and the product distilled in an iron retorting furnace, which still remains.

Tlalchichilpa mill—This was the most extensive plant of all, and it occupies a large level site, at an elevation of 3,900 ft. and adjoining the mouth of the Tlalchichilpa adit. The crushing equipment comprises ten stamps, all of California type, as in the other plants, and five 10-ft. Chile mills. The brick floors, for amalgamating the ore by the patio process, are of large area.

Restauradora mill—This plant was built near the top of the divide above Huantla, at an elevation of over 4,000 ft., in order to be near the Restauradora mine and to utilize a perennial spring of water in the vicinity. The building is constructed of sawed lumber, hauled in from Cuantla, and is covered with corrugated iron. The location is on a hillside, so that the ore moves entirely by gravity through the different processes. Brought by wagon or on mule-back from the mines, the ore is weighed and then falls onto a sloping grizzly 18 ft. long and with 1-in. openings. The oversize goes through a 7 x 10-in. Blake crusher, and, along with the undersize, falls into a wooden ore bin. From this bin the ore descends into two Tulloch automatic feeders, each of which supplies a battery of five stamps. The resulting pulp is amalgamated in one of six Boss 6-ft. pans, and is then separated from the amalgam in one of three 8-ft. clean-up pans. There is also a retorting furnace, a melting furnace, an assay furnace, and a 3-ft. amalgam-cleaning pan. Power is supplied by a 12 x 24-in. horizontal engine, with Meyer valve gear, and steam by two return-tubular boilers, 4 ft. in diameter by 20 ft. long. All equipment came from the Union Iron Works, of San Francisco.

Possibilities of Modern Mining

All the ancient mines, described above, seem to have been exhausted of their ores amenable to pan-amalgamation. The sulphide ores, which still remain below water level, contain so much lead and copper that they are unsuitable for cyanidation and must therefore be concentrated, to free them from quartz, and smelted. Little smelting could be done locally, owing to the lack of wood for making charcoal; for the primitive forests have long ago been destroyed, and only a scanty second growth of mezquite and various deciduous trees remain. Besides, the nearest limestone is at Ixtaluca and iron flux is still farther away. Labor in Morelos is now so scarce and inefficient that it will be advisable in future to use machine drills in mining the hard quartz of the veins. However, the scarcity of fuel will restrict the possible use of steam power in mining and milling. Yet plenty of water power can be cheaply developed at the falls of the Rio Amacuzac, 25 km. northwest of the camp.

Placer Mining Investigations in Alaska

An investigation of methods and costs of placer mining in various Alaska districts is being conducted by the Alaska experiment station of the Bureau of Mines, at Fairbanks. All mines operating in the Seventymile, Fortymile, and Woodchopper Creek districts have been visited, and detailed data were secured as to methods, equipment, and costs of this work.

The Marketing of Quicksilver

Italy and Spain Supply Bulk of Production—United States Must Compete Against Cheap Foreign Output —San Francisco Is the Primary Market in America

By H. W. Gould

QUICKSILVER is used as such in the amalgamation of gold ores, in gas governors, thermostats, barometers, and various other instruments, and for electrical apparatus. In chemical compounds it finds a wide variety of uses. Probably the best summary of the quantities used for the more important purposes is given in *Mineral Resources*, published by the U. S. Geological Survey, in the form of a survey made in 1917. The quantities indicated are probably in some instances greater than would be used for similar purposes under normal conditions and in others less. The estimate is as follows:

	Flasks of 75 Lb. Each
Drugs and chemicals	8,500
Fulminate	4,850
Vermilion	3,130
Oxide (for anti-fouling marine paint)	3,000
Electrical apparatus	2,700
Felt manufacture (especially hats)	1,700
Gold and silver amalgamating mills	850
Instruments	630
Miscellaneous, boiler compounds, and cosmetics	1,000
Total	26,300

The industries using the metal directly are the gold and silver mining industry (practically no quicksilver is now used in the United States for amalgamating silver ores), instrument makers, and the manufacturers of electrical apparatus and incandescent lamps. The blasting cap and explosives industries are the chief users of mercury fulminate. Chemical manufacturers and the makers of pigments are the principal consumers of quicksilver for the manufacture of oxide, sulphide, and mercurous and mercuric chlorides. Chemical manufacturers also use quicksilver in the manufacture of certain chemicals, such as glacial acetic acid, phthalic acid, and phthalic anhydride. Manufacturers of storage batteries also use a small but increasing amount.

The Orient consumes a considerable quantity of quicksilver. South Africa, India, Canada, and all gold-producing countries where placer and lode gold are produced annually require approximately 0.01 lb. for each ton of low-grade ore treated in modern mills, according to Sharwood. Thus, wherever gold is produced, a market for quicksilver will be found. In the United States the important chemical manufacturers are in close proximity to large population centers such as New York, Chicago, St. Louis, Philadelphia, and other cities to a less degree. Before the war Germany was rapidly becoming the largest market for quicksilver, but since 1918 it has never attained anything like its 1914 volume.

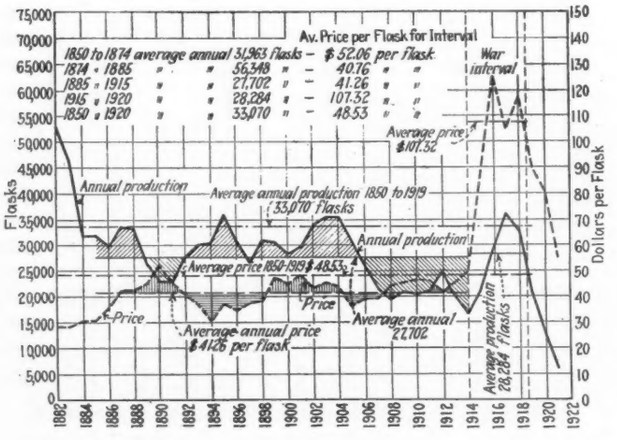

Av. Price per Flask for Interval
1850 to 1874 average annual 31,963 flasks — $ 52.06 per Flask
1874 " 1885 " " 56,348 " — 40.76 " "
1885 " 1915 " " 27,702 " — 41.26 " "
1915 " 1920 " " 28,284 " — 107.32 " "
1850 " 1920 " " 33,070 " — 48.53 " "
War interval
Average price $107.32
Annual production
Average annual production 1850 to 1919 33,070 Flasks
Annual production
Average price 1850-1919 $ 48.53
Price
Price
Average annual price $41.26 per Flask
Average annual 27,702
Average production 28,284 Flasks
Flasks
Dollars per Flask

Fig. 1—Quicksilver production in the United States and average prices

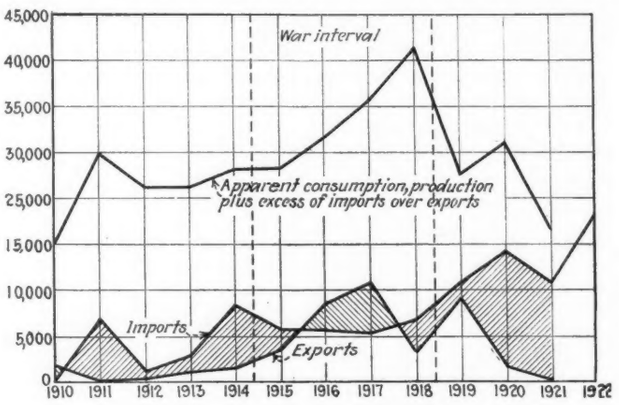


Fig. 2—Imports, exports and apparent consumption of quicksilver in the United States

San Francisco the Principal American Market

The primary market for quicksilver in the United States is San Francisco. New York is a market in which quicksilver is resold. In Europe the primary markets are London, Madrid, Trieste, Rome, and Leghorn. Secondary markets or markets in which the quicksilver or its products are sold to consumers and others exist in all large cities and wherever there are chemical supply houses.

Quicksilver consumption closely approaches production plus a varying differential representing the difference between imports and exports. Stocks of quicksilver are carried at times by producing companies, by sales agents, and by speculators. Just at present there is a large quicksilver stock in the United States, due to imports made in anticipation of the passing of the quicksilver tariff. The domestic production of quicksilver is largely influenced by competition from foreign producers. Without this competition, the domestic production would or could provide the entire domestic consumption and also the relatively small volume of exports. Production and primary prices for a number of years are given in Fig. 1. The apparent consumption is given in Fig. 2. Both figures have been compiled from statistical tables in *Mineral Resources*. The maximum apparent consumption of recent years occurred in 1918, when it reached 36,504 flasks. This was abnormal. Normal consumption may vary from 20,000 to 30,000 flasks. Seasonal demands do not

exist, the demand being more or less distributed over the year, but more is sold in some months than in others.

Owing to the fact that quicksilver is recovered from its ores by distillation, the quicksilver sent to the market is in a comparative state of high purity. No specifications are therefore necessary other than the one that the metal must be pure and clean. No special brands are recognized. Where foul or impure mercury is sold, it is sold as such and does not come under the category of virgin metal. Considerable of this dirty metal was recovered from the old silver-lead mine tailing dumps of Mexico during the war.

The unit handled in the market is the flask, which in the United States markets contains 75 lb.; the European flask contains 34.50 kg. for European trade and 34 kg. for export to the United States. Transactions are on the basis of flasks, and no smaller quantity is handled in the primary markets. In secondary markets the quantities vary widely. The market for quicksilver is necessarily narrow, and, being a commodity cheaply stored without deterioration, it lends itself easily to manipulation, and this often causes sharp fluctuations in the price. The large buyers take advantage of this condition and buy low, and the producer, generally weak financially, must sell as he produces.

Metal Sold Principally by Brokers

Only two companies of all the domestic producers ship quicksilver in car lots. Certain agents who buy small lots of quicksilver ship by rail or water to New York in car lots. The wrought-iron quicksilver flask is the container handled, and this requires no boxing or other protection. The usual car lot is 425 flasks. Shipments are frequently insured. Especially was this so during the war, when high prices were obtained for quicksilver.

Quicksilver is shipped on consignment by agents or by the large producers. It is sold on commission, the basis of sale by agents being usually 2½ per cent of the selling price. Payments are generally made by the middle of the month following the sale. The agent sells as quickly as he can and at as high a price as he can get, or as instructed by the seller. The small producers sell to agents, who, if they practice strictly as agents, sell on consignment. Some agents occupy the dual rôle of both traders and agents. As traders they pay cash to the small producer, or, if he prefers, they will sell on consignment for a percentage of the selling price. It is obvious that such agents favor their own interests on a falling market by first selling the quicksilver which they have purchased outright for as high a price as they can get, and later selling other quicksilver, for which they are to act as agents, when they can, but after they have disposed of their own holdings. Such traders usually pay the small producer from whom they purchase outright 50 per cent or more of the purchase price as an advance payment and the remainder when they have sold the lot. Under other circumstances they pay the full purchase price, which may be an appreciable amount less than the market, and rely upon the differential thus created to pay the carrying costs and their profit. The small producer is thus at a decided disadvantage when he places his output in the hands of the trader-agent, who is to a certain extent a speculator.

The small producers are unorganized and must take their chances with traders and agents, or, where they can establish connections with the larger producers, they may dispose of their product through them with greater advantage to themselves. Usually, the lots handled by the small producer are so small, and his knowledge of the avenues through which his product may be marketed is so slight, that he cannot profitably undertake the marketing himself. Efforts in the past have been made to form an association of producers of quicksilver, and one was formed many years ago, but dissension among the operators finally forced it to quit. Obviously, a central selling agency would be an advantage to the small producers, and to the large ones as well, but as most small producers would require a substantial advance against the quicksilver which they

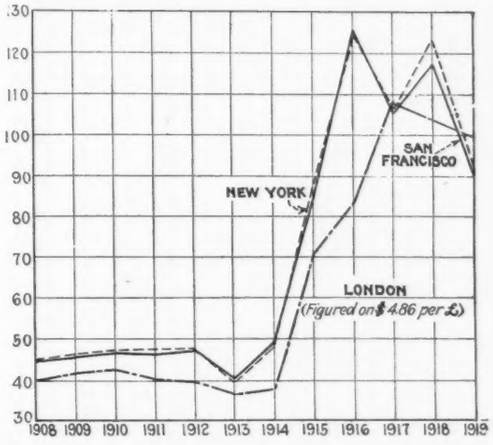


Fig. 3—Variation between San Francisco, New York, and London prices

would send to such an agency, an effective agency would have to be in a position to finance its operations. It is also a matter of doubt if the operations of an agency of this kind would stand the test of legality under the anti-trust laws.

Influence of the Rothschilds Weighty

In the world market, the English house of Rothschild once controlled the entire Spanish quicksilver output under an agreement which was renewed every ten years. Through Continental agreement with the Rothschilds, the European quicksilver production was practically massed and handled with such skill as to keep American producers in more or less uncertainty with respect to prices in their domestic market. Since the war, the European market control of quicksilver has been changed. Spanish production is, since Jan. 1, 1922, controlled by the Spanish Government. Italian production is controlled by the Italian Government, which works in conjunction with the two large operating companies.

In the United States, a tariff taking effect in October of this year has established a differential of 25c. per lb., or $18.75 per flask, in favor of domestic production. This differential will establish more or less equilibrium between domestic and foreign quicksilver in the domestic market. Domestic production in the United States is in the hands of private enterprise, whereas the chief foreign producers are government-controlled and government-operated enterprises. It is to be expected that in the former case production costs will be kept at a minimum, and in the latter both costs and operation may be expected to suffer.

Quicksilver prices are shown in Figs. 1 and 3. The

figures for this chart were taken from *Mineral Resources*. Quicksilver prices fluctuate widely. The three chief marketing places, London, New York, and San Francisco, present quotations which differ in moderate degree. Practically all of the quicksilver sold in San Francisco is finally sold in New York, except that sold for export from San Francisco. Texas quicksilver is nearly always shipped direct to New York and marketed there. The New York price is usually slightly more than the San Francisco price, although occasionally the reverse is true. The London price is less than either. *Engineering and Mining Journal-Press* quotes both the New York and the San Francisco prices. Both are obtained from transactions of agents. In transactions in San Francisco the prices between the several agents may vary, but an attempt is made to average them. The price quoted is the agents' selling price and not that paid to the producer, which is usually considerably lower and depends on whether the agents are anxious to buy or to sell.

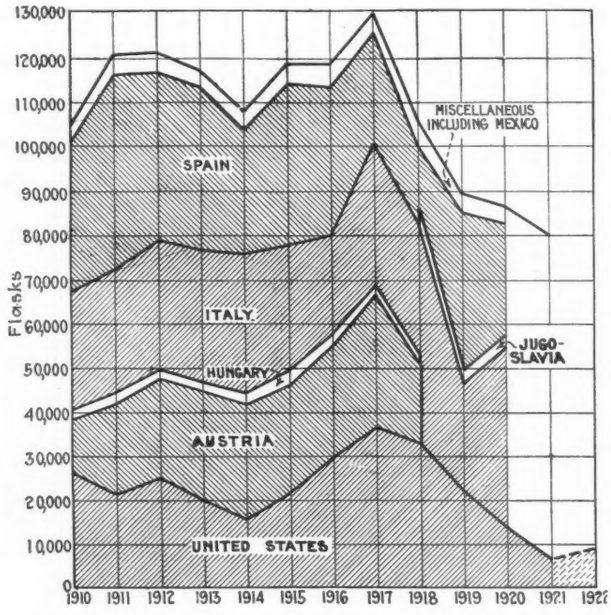


Fig. 4—Cumulative world quicksilver production

Imports greatly influence prices in the domestic market. During the last nine months the quicksilver imports totaled 18,225 flasks, of which Italy shipped 12,217 flasks, and Spain 4,467 from London and 700 from Spain, and miscellaneous shipments, chiefly from Mexico, were 841 flasks. This large importation was due to the passing of the tariff upon quicksilver. It amounts to almost a year's consumption.

The 1921 production of the United States was approximately 6,300 flasks, and 1922 will show only a small increase. Thus the importations for nine months are slightly less than three times as great as the present domestic production.

The possibilities of foreign competition prevent the domestic price of quicksilver from rising to a level commensurate with the production. Undoubtedly the domestic industry would be prosperous if the law of supply and demand operated without interference by foreign intrusion. The tariff differential and the small freight charge from Europe to America are the only factors which are to the advantage of the domestic producer. His deposits are low grade, the price of labor is relatively high, and only by superior skill and the use of mechanical appliances can he hope to compete against the foreign producer, who has the advantage of higher-grade deposits and a much lower scale of wages.

Fig. 4 indicates the relative productions of different countries and the total world production.

Billiton Mines Privately Operated

The tin deposits on the island of Billiton, in the Dutch East Indies, are operated by the Billiton Maatschappij under the concession obtained from the government in 1852, which in 1892 was extended for a period of thirty-five years, by virtue of which five-eighths of the net profits go to the colonial government in the form of a royalty. It is understood that the concession will not again be renewed by the government and that it definitely expires in 1927, according to *The Far Eastern Review*. It is generally believed that the government will continue the operation of the mines on its own behalf. The private interests controlling the Billiton Maatschappij have formed in Holland a new company called the Stannum Mining Co. with a capital of 500,000 florins (florin at par = $0.402) for the purpose of taking over the machinery and equipment owned by the old company, probably with a view to operating in some other field after 1927.

The work of mining at Billiton is done by Chinese coolies under contract, the average number of laborers in 1920 being 18,000. In 1914 there were 47 mines or pits being worked, and in 1918 only 30. Production in 1913 amounted to 4,453 metric tons, in 1917 to 6,492 tons, in 1918 to 6,945 tons, in 1919 to 7,325 tons, and in 1920 to 7,956 tons. Electrical equipment has been installed for the working of the ore, the largest installation being at Manggar. The motive power at this station is furnished by six Diesel motors of 1,200 hp. each.

Alaskan Mining in 1921

In a recent bulletin (739-A) the U. S. Geological Survey states that the most important event of 1921 to the future of the Alaskan mining industry was the practical completion of the Alaska Railroad (the government line). There only remains to be built the bridge across Tanana River. Also, there is good reason to believe that the ocean transportation service to Alaska is soon to be improved. These betterments of means of communication are the most valuable local factors in promoting the revival of the mining industry there.

The dominant features of the year's mining, according to the Survey, were (1) the decrease of both copper production and development, owing to the low price of the metal; (2) the closing of the Perseverance mine, one of the three large auriferous lode mines at Juneau; (3) continuation of activity in auriferous quartz development in the Sitka, Juneau, Salmon River, and Willow Creek districts; (4) a revival of placer mining; (5) continuation of systematic prospecting for coal in the Matanuska field by the Naval Coal Commission; (6) the many examinations made in Alaska petroleum fields by oil companies, with the purpose of drilling. The discovery in a new locality of galena and other sulphide deposits in the Kantishna district is also worthy of special note.

THE PETROLEUM INDUSTRY

The Oil Executive and Geology*

BY J. H. JENKINS

The executive through constant use of geological data soon becomes convinced that he can read and interpret a map as readily as a geologist. This is a very dangerous proceeding, not because he is not competent to understand the report, but because he gets only the bare facts and knows but little of various factors that enter into the work from which the report is made.

It seems to be a common trait among executives to follow after false gods. An article in an oil journal or a report on some area more or less remote submitted by a broker is frequently considered sufficient justification to call upon the geologist to visit the district referred to, regardless of what other work may be on hand. It is obvious that reports received in this manner are public property, and, consequently, whether by design or otherwise, call attention to the district with the enhancing of a reputation of a pocketbook. It is not the intention here to say that this should not be done, but first it should be ascertained whether or not work on hand that is being done specifically for the company is of more or less importance than that which comes from outside sources.

Because of the expansion in the oil business in the last few years, a great amount of time is spent by the geologist in looking over this and that proposition, without, apparently, accomplishing anything. It is the natural thing to call upon him to drop whatever he may be doing and send him to report upon an area that is in the limelight. The geological department becomes more or less of a scouting department. The result is that the department becomes personally directed. The head of the department, instead of planning and doing constructive work, finds himself falling into a rut and spending the greater part of his own and his department's time in keeping up with the requests for data. It is doubtful whether many executives have ever given a thought to this. They are beset with many things which they must know and call for help wherever they can find it. The needs of the present are so great that very little thought is given to the future. The geologist, instead of becoming a thinking machine, becomes a Pullman hound. If the executive knows that he can plan the geologist's work to better advantage than the geologist, or if he has one whose work must be planned, he should reduce overhead by getting rid of his head of department and become in fact the head, or replace his present head by one whom he deems competent to plan and carry out the work. If the latter course is followed, the executive should then give the same supervision to this department that he does to the production of any other department.

It is apparent that the geologist must have time to study, to think, and to develop some ideas of his own, to visit his neighbors and compare notes. Unless he does this he will become a fossil. He cannot do it and be on the jump all the time. Building up knowledge of a science is not a matter of days or months. It is a question of years of hard work and study. Ten years ago the geologist was usually asked, "tell us where the high place is, we'll do the rest." Today subsurface study comprises 50 per cent of the work. The next ten years will see his duties extended to encompass a very much wider range than the past.

Knowledge of geology is as old as the human race. Its application to the petroleum industry in a practical manner is so new that the old men in the profession are comparatively young. Eventually the heads of the various companies realizing the advantages of co-operation should endow a board of scientists whose interests lie not on the practical side but on the academic. This would be particularly beneficial to the men on foreign work.

The executive also has his complaint. He secures a man who admits that he is good; pays him a big salary, and apparently gets no results. The overhead increases by one department. The production remains stationary. Practically all the results are negative when what is wanted is some action and some positive results. About the only chance of getting a proper perspective of the situation is to sit down and figure with the geologist on what it is going to cost to hasten results. Find out how much territory is being covered per man per day; how much is to be covered; how much ought to be covered; how many thousand years it would take one man to do it all; how much could be followed up with investments if it were all done, and then plan a campaign that will come as near to meeting the needs of the company from all standpoints as possible. Don't allow the department to become top-heavy. If you do, your best men will do nothing but check the work of the others who are not to be relied upon fully. If you are not entirely sure of the information obtained, don't hesitate to ask for more data and give more time in which to secure it. Don't give the department too much work.

It has seemed for years that the thing needed above everything else in connection with geological work has been a better understanding of the vast amount of time necessary and work needed to bring the known facts regarding the production of oil into use, and to bring a portion of the much vaster number of facts about which so little is known into the known class. Every year a little knowledge is added. Every year a little better understanding of how little we know is grasped. As fast as one problem is solved, two more problems loom up which had not been considered. Co-operation between the executive and the geological department will advance the work faster than any other thing. The executive should give consideration to this factor and assist.

*Excerpted from a paper presented at the annual meeting of the American Petroleum Institute at St. Louis, Mo., Dec. 8.

New Books

Three French Works on Mining and Metal Marketing

REVIEWED BY J. E. SPURR

Traité Général de Commerce des Minerais et Metaux. By R. Pitaval and L. Ganet. 2d edition. By R. Pitaval. Publications Robert Pitaval, 7 Rue d'Offémont, Paris. 1,224 pages.

The first edition of this work appeared in 1916, but is now largely rewritten. The book begins with a summary of the mineral and metal markets since 1913: passes to general considerations of marketing, to transportation, shipping, and metal markets. The author is more familiar with marketing at Paris and London than at New York. He treats of the selling of old metal, of sampling, the rules governing metal and mineral marketing, and other useful general matters; then proceeds to take up each commodity separately and alphabetically, from aluminum to zinc, and including the non-metallic ores. Under copper, for example, are treated the subjects of production, ores, ore deposits, sales formulas (German, English, Spanish, American, etc.), the Chile copper trade, marketing, the principal producing groups, the various brands of copper, specifications, marketplaces (bourses)—New York, London, Hamburg, etc.—the price of copper since 1801, uses of copper, and other matters relating to the metal.

The work is essentially and entirely a book of references, but is very full of data: an especially useful book for traders and students of metal marketing. For such, it is a most valuable compilation.

Cours d'Exploitation des Mines. By L. E. Gruner. Three volumes, pp. 1,087, 740 figures. Paris, Librairie de l'Enseignement Technique, 3 Rue Thenard. 1921. Price 30 francs per volume.

This is a course in mining engineering for students, and is worked out with clearness and detail. Vol. I, beginning with a chapter on geology, passes to the question of power for mining, prospecting, drilling (for exploration), rock breaking, explosives, drilling (for blasting), and loading and blasting. Vol. II treats especially of the methods of supporting, including timbering—timbering in general, timbering of stopes, of drifts, metal supports, walling, sinking and timbering of shafts, sinking in dry formations, sinking and pumping, permanent supports in dry rock, permanent supports in wet formations, sinking of wet shafts by the freezing method, sinking of wet shafts by the cementation method, shaft sinking by the compressed-air method, repairing, enlarging, and deepening shafts. Vol. III treats of open-cut and underground mining methods. Under the latter is considered mining and leaving pillars, caving methods, filling systems, the mining of thin seams, of medium and thick beds, hydraulic filling, the working of metal mines, and the results of mining upon the surrounding rocks.

As may be surmised from the above, the author has coal mining continually in mind, which is by far the most common form of mining in France.

Ateliers Modernes de Preparation Mecanique des Minerais. By J. Roux-Brahic. Pages 896, 425 figures, 1 plate; Librairie Dunod, 47 Quai des Grands-Augustins, Paris, 1922. Price, 90 francs.

This is another of the excellent works on mining in its various phases which have recently appeared in France. This volume, which is more complete and up to date than anything we have in English, treats of ore dressing. It is preceded, rather strangely, by a chapter on the marketing of metals. The first part of the volume, besides this, is occupied with various general considerations having to do with ore dressing. The second part (Chapters VI to X) has to do with coarse breaking, grizzlies, cobbing, picking belts, and coarse crushers of various kinds. The third part (Chapters XI to XIX) discusses the treatment of sand—the physical and mathematical principles underlying the fall of coarse fragments and sand in liquids, screening, trommels, classifiers, jigs, and washers. Part four (Chapters XX to XXVII) discusses the treatment of fines and slimes—fine-grinding mills, including ball mills and stamps, and their feeding arrangements; the classification of fines by various methods and apparatus; the thickening of fines and slimes; concentration tables, vanners, buddles, and air-classifiers. The fifth part (Chapters XXVIII to XXXI) treats of electric ore dressing: magnetic separators, descriptions of plants where magnetic separation is practiced; electrostatic separation. Part six (Chapters XXXII and XXXIII) treats of flotation, and the seventh part gives detailed descriptions of modern ore-dressing plants. American plants constitute a majority of those described in this section.

Another Readable Book on China

Mineral Enterprise in China. By William F. Collins. Revised Edition. Tientsin Press, Ltd., Tientsin, China.

An extremely valuable, careful, and interesting book. It should be read by anyone contemplating mining ventures in China and by those interested in understanding conditions under which mining has gone on in that country.

The Chinese, being essentially an agricultural nation, have on the whole attempted to minimize mining, only enough for coinage and other elementary uses being aimed at; and the conduct or at least the right to revenue from mining has been considered primarily to belong to the state rather than the individual. One can learn very much about the Chinese character from the book. It is also published in Chinese. J. E. SPURR.

Technical Papers

Mining Nitrate—The modern methods of mining adopted in the Chilean nitrate industry are described in a four-page article in the November *Compressed Air Magazine* (11 Broadway, New York City; price, 35c.), "Mining Sodium Nitrate in Chile."

Electrical Equipment in Mines—"Operation and Maintenance of Electrical Equipment Approved for Permissibility by the Bureau of Mines" is the title of Technical Paper 306, 23 pages, obtainable on request from the U. S. Bureau of Mines, Washington, D. C. It is of chief interest to coal miners.

Chinese Tin Mining—The mining and smelting of tin ores at the Kochiu tin mines are briefly described in a four-page illustrated article in the September issue of *The Far Eastern Review* (5 Jinkee Road, Shanghai, China; price, 50c.). The data given are abstracted from William Semple's report on the district recently presented before an English institute of marine engineers.

Miner's Phthisis—"The Problem of Dust Phthisis in the Granite-Stone Industry" is covered in Bulletin 293 of the U. S. Bureau of Labor Statistics, Washington, D. C., 178 pages, obtainable on request. Over 400 physical and X-ray examinations of stone workers in the Barre district of Vermont were made in the investigation covered by this report. It is said that extensive silicosis may exist with little or no impairment of health and that therefore periodical X-ray examinations are highly desirable to detect the first stages of lung damage.

Oxy-Acetylene Welding—A sixteen-page pamphlet on oxy-acetylene welding has been issued by the Directorate of Research of the Air Ministry. It is obtainable for 10d. from H. M. Stationery Office, Princes St., Westminster, London, S. W. 1, England. This booklet is eminently practical and will be found generally useful.

Aluminum Market—In *The Mining Journal* for Oct. 28 (15 George St., Mansion House, London, E. C. 4; price 8d.) Cyril Fox begins a series or articles entitled "Aluminium: The World's Output and Producers." The first installment (1¼ pages) sketches briefly the history of production up to the present and discusses the organizations in control of the industry in Austria, Belgium, and France.

Economic Geology—The November issue of *Economic Geology* (Lancaster, Pa.; price, 65c.) contains articles on the "Origin of Zinc Ores of Sussex County, N. J." (52 pages); "The Geologic and Geographic Occurrence of Precious Stones" (27 pages); and "Origin of the Bilbao, Almeria, and Santander Iron Ores" (17 pages).

Rand Metallurgy—Present practice in the metallurgy of the gold ores of the Rand is described in a five-page article in the Sept. 30 issue of the *Journal* of the Society of Chemical Industry (Central House, Finsbury Square, London, E. C. 2; price, 3s. 6d.). The description applies chiefly to the New Modderfontein plant.

Drill Steel—In the *Compressed Air Magazine* for November (11 Broadway, New York City; price, 35c.) appears a nine-page article with many excellent illustrations on "Drill Steel—Its Forging and Heat Treatment." The best steel may be spoiled by ignorance or lack of proper care in the blacksmith ship, and the information given in this article should be carefully digested by those doing and having charge of such work.

Titanium—*Reports of Investigations*, Serial No. 2,406, issued by the U. S. Bureau of Mines, Washington, D. C., is a 12-page bulletin on titanium. The subjects covered include: physical and chemical properties, uses, preparation of the pure metal, titanium minerals and ores, manufacture of alloys, production, and prices. A bibliography containing 33 references is appended. It may be obtained free from the Bureau.

North Carolina Hematite—The "General Features of the Brown Hematite Ores of Western North Carolina" are discussed in U. S. Geological Survey Bulletin 735-F, 52 pages, obtainable on request from the Survey at Washington, D. C. This region may become an important producer when the demand for ore of this kind becomes more pressing than it is at present.

Limestone Quarrying — "Stripping Problems in Limestone Quarries of the Shenandoah Valley" is the title of U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,401, 6 pages, obtainable on request to the Bureau at Washington. This is the first of a series of papers on the various phases of limestone quarrying for lime manufacture, and it is hoped that those who are interested will secure copies and offer free criticism.

Queensland Report—The annual report of the Under Secretary for Mines of Queensland, for 1921, 141 pages, price 4s. 6d., is now obtainable from the Department of Mines, Brisbane, Queensland, Australia.

Arizona Guidebook — Water-Supply Paper No. 490-D is the fourth of series of guidebooks of the desert regions of Arizona, which have recently been mentioned in these columns. The present book covers the Papago country—the district around Ajo. It may be obtained free on application to the U. S. Geological Survey, Washington, D. C.

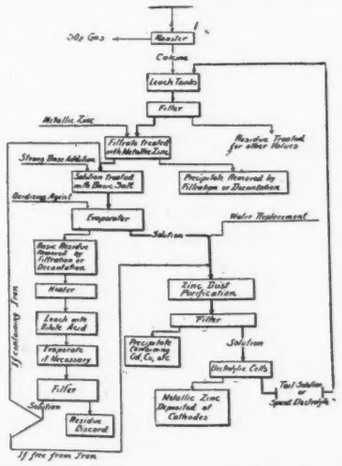
World's Lead Trade—The November issue of *Commerce Monthly* (obtainable gratis from the National Bank of Commerce, New York City) contains a seven-page article on the "Lead Trade of the World."

Recent Patents

Tin Smelting—No. 1,426,341. H. H. Alexander, Westfield, N. J., assignor to American Smelting & Refining Co., New York. Tin concentrates are mixed with carbonaceous material, the mixture sintered until approximately 70 per cent of the sulphur originally present in the mixture has been removed, and the broken sinter mixed with carbonaceous material and smelted in a blast furnace.

Ore Reduction—No. 1,426,507 Richard Rodrian, New York, assignor to Rodrian Electro-Metallurgical Co. Metal-containing material is smelted above a body of suitable molten metal, and then an electric current is passed through the molten charge, the molten metal being used as the cathode.

Electrolytic Zinc Process—No. 1,429,330. J. T. Ellsworth, Park City, Utah. In the treatment of zinc ore with a cyclic solvent solution, the solution is concentrated before electrolysis and



soluble salts are removed therefrom so that the concentration of these salts will at no time become so great as to cause their precipitation in later stages of the cycle.

Metals From Silicates—No. 1,426,890. F. M. McClenahan, Oakmont, Pa. Metals are recovered from silicates containing them by decomposing the silicates by an excess of ammonium-fluoride solution. Patent No. 1,426,891 covers the recovery of hydrated alumina from an intimate mixture of aluminum and ammonium fluorides by heating in the presence of water, and removing the resulting vapors.

Hydrometallurgy of Zinc—No. 1,435,699. N. C. Christensen, Salt Lake City. Zinc-sulphide ores and concentrates are mixed with hot sulphuric acid in sufficient quantity and concentration to decompose the zinc sulphide, form zinc sulphate, and dissolve the zinc sulphate. The mixture is then cooled and the zinc sulphate precipitated. Patents Nos. 1,434,084 and 1,434,086, to the same applicant, cover similar processes.

Mixture for Zinc Retorts—No. 1,424,120. W. F. Rossman, St. Louis, assignor to American Zinc, Lead & Smelting Co., St. Louis. A refractory material for zinc retorts, composed of plastic clay, finely pulverized silica, and ground grog about equal in amount to the silica, all mixed together in a plastic state.

Electrolytic Process—Canadian patent No. 224,229. Gustaf Haglund, Christiania, Norway. An electrolytic process, designed particularly for the treatment of copper and nickel sulphides.

Oil-Shale Treatment—Canadian patent No. 224,242. J. B. Jenson, Salt Lake City. An eduction furnace for oil shale consisting of superimposed units discharging from one to another by means of screw conveyors.

Potash From Feldspar — Canadian patent No. 224,329. The Potash Extraction Corporation, New York City, assignee of Walter Glaeser, Brooklyn. Feldspar is burned at a low red heat, cooled suddenly, mixed with anhydrous calcium chloride, and then fused at a temperature between 1,200 and 1,800 deg. C. Patent No. 224,330 covers the same process, except that burnt lime, in amount less than 20 per cent of the feldspar, is used instead of the calcium chloride. The ground product is used for agricultural purposes and may be treated with sulphuric acid to form potash alum.

Platinum Recovery—No. 1,429,378. Russell Thayer, Philadelphia. Platinum and associated metals are extracted from ores by forcing a blast of superheated steam through a highly heated body of finely ground ore. The platinum metals are recovered from the resultant fume.

Ore Classifier—No. 1,429,480. Charles Allen, El Paso, Tex. A method of bypassing the upward-flowing stream of water in a shaft connected with a cone classifier, to promote the proper settling of the solid material.

Differential Flotation—No. 1,429,544. Blamey Stevens, Triunfo, Baja California, Mexico. To a flotation pulp is added a selective reagent which is a solvent for floatable metals in the ore being treated, and which is saturated with one of such metals. The metal of saturation is then floated.

Concentration of Carnotite — No. 1,429,550. L. F. Vogt, Washington, Pa., assignor to Standard Chemical Co., Pittsburgh. A process of concentrating ore of the carnotite type, consisting in destroying the cementing function of the mineral, crumbling the ore, and classifying the resultant product to recover the valuable constituents.

Concentrating Riffles—No. 1,429,750. S. J. Marsh, Quesnel, B. C. The patent covers a launder having relatively deep blanket-covered riffles across its width, riffles being at an angle of at least 20 deg. from the horizontal, and adapted to recover the gold and other precious metals from ores.

Drill Bit — No. 1,426,637. A. L. Hawkesworth, Butte, Mont. A new form of drill bit.

RECENT PATENTS
Continued

Hydrometallurgy of Zinc and Lead—No. 1,430,269. W. G. Waring, Webb City, Mo., assignor of one-half to Gordon Battelle, Columbus, Ohio. Zinc is extracted from zinc-lead compounds with hot ammonium sulphate solution. The solution is subsequently cooled, with accompanying deposition of zinc compounds, which latter are treated with ammonium-carbonate solution to convert them into zinc carbonate and to form ammonium sulphate. According to patent 1,430,270, the lead residues from the first step of the process are treated with ammonium-carbonate solution containing ammonia equivalent to the sulphur trioxide present in the residues. Lead carbonates are thereby formed and also an ammonium-sulphate solution containing zinc which can be reused in the extraction step.

Zinc-Lead Fume—No. 1,430,271. W. G. Waring, Webb City, Mo., assignor of one-half to Gordon Battelle, Columbus, Ohio. Sulphur-carrying zinc-lead fume intended for pigments is roasted at a low temperature to remove volatile impurities and to render the cadmium soluble as sulphate. The cadmium is them extracted by water leaching.

Retort Furnace—No. 1,430,445. C. C. Grimes, Idria, Calif. A furnace for retorting ores carrying volatile constituents (presumably quicksilver ores) and means for collecting the fume.

Concentrating Table—No. 1,429,845. G. T. Cooley, Joplin, Mo. A double, riffled concentrating table with a single head motion.

Gyratory Crusher—No. 1,436,338. C. L. Carman, New York, assignor to J. E. Kennedy, New York. An improvement in the design of gyratory crushers.

Treating Biotite — No. 1,430,085. James Keeth, Spokane, Wash. "Books" of biotite are treated at a temperature of about 700 deg. F., whereby they are dehydrated and "lofted." The product is then ground.

Amalgamator—No. 1,430,091. C. C. McBride, Sanger, Calif. A sluice provided with an amalgamating compartment comprising an amalgamated plate, liquid mercury, a solution of sodium chloride, and electrical connections.

Precipitating Copper—No. 1,430,140. F. S. Adams, Anaconda, Mont. A method of precipitating copper by repeatedly passing sulphur dioxide through hot copper-containing solutions.

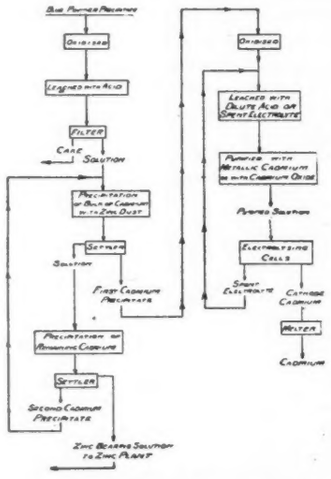
Coloring Metallic Copper—No. 1,428,170. Frederick Laist, Ernest Klepetko, F. F. Frick, and L. P. Davidson, Anaconda, Mont., assignors to Anaconda Copper Mining Co., Anaconda. Copper is colored by treatment with a concentrated water solution of a copper salt.

Concentrator—No. 1,428,392. W. P. Ogden, late of Denver, Colo., by Maude E. Holmes, Spokane, Wash., assignor to J. M. Schnatterly, Spokane, Wash. A method of concentrating the precious metals in black sand, comprising a flume, with grizzlies, baffles, and concentrating tables.

Electric Furnace—No. 1,427,436. W. E. F. Bradley, Nyack, N. Y. Method of construction of an electric furnace of the tilting type, with arrangements for supplying reducing gas to a carbon tuyère independent of the electrodes.

Volatilization—No. 1,427,765. H. R. Layng, late of San Francisco, by Hattie F. Layng. Valuable elements in an ore are volatilized by heating the ore or mixture so rapidly that harmful reactions are prevented.

Electrolytic Treatment—No. 1,426,703. David Avery, Melbourne, Victoria, and R. H. Stevens and R. T. D. Williams, Risdon, Hobart, Tasmania, assignors to Electrolytic Zinc Co. of Australasia, Proprietary, Ltd., Melbourne, Victoria. A process for the treatment of blue powder precipitate obtained in the purifying of zinc-bearing solutions for electrolysis, comprising oxidizing the precipitate, dissolving



the metal oxides in dilute sulphuric acid sufficient to dissolve a maximum amount of zinc and cadmium, separating the cadmium- and zinc-bearing solutions from the residue, and recovering the cadmium and zinc from the solution so obtained.

Flotation Reagents — No. 1,427,232. Alfred Schwarz, Joplin, Mo., assignor to Metals Recovery Co., New York. A method of producing flotation reagents by extraction first with an aquaeous alkali, then with an acid.

Pulverizing Mill—No. 1,427,234. D. V. Sherban, Canton, Ohio. A grinding mill consisting of a rotatable drum and grinding balls, and a suction screen axially passing through the drum into which the ground material is admitted.

Flotation — No. 1,327,235. G. E. Sheridan and George G. Griswold, Jr., Butte, Mont. An ore containing iron and other metallic sulphides is prepared for flotation by being first treated with a cyanide and an alkaline salt, by reason of which the flotation of the iron is in large part inhibited.

Concentrating Table Head Motion—No. 1,433,500. Emil Deister, Fort Wayne, Ind., assignor to Deister Machine Co., Fort Wayne. A head motion for a concentrating table.

Societies, Addresses and Reports

Harding Comments on Report of F.A.E.S.

Says Twelve-Hour Day Must Give Way to Better Form of Organization

The twelve-hour day and the type of worker it produces have outlived their usefulness in American life, President Harding declares, commenting on the report of the Committee on Work-Periods in Continuous Industry of the Federated American Engineering Societies. This committee, after two years of investigation of more than forty continuous industries, including steel and iron, found that the twelve-hour day was not an economic necessity. These findings, President Harding says, represent his "social viewpoints."

The President's statement, which will be embodied in the report, now being compiled by the F.A.E.S., was given out in New York by the chairman of the committee, Dr. H. E. Howe, of the National Research Council, Washington. It follows:

"It is a matter of very much gratification to me that the Federated American Engineering Societies, our foremost organization of American industrial skill, should have given two years of diligent inquiry, under competent experts, to a subject which is of very deep interest to me, and important to the country.

"I rejoice to note the conclusions of this great body of experts are identical with those which I have reached from a purely social viewpoint. It has seemed to me for a long time that the twelve-hour day and the type of worker it produces have outlived their usefulness and their part in American life in the interests of good citizenship, of good business, and of economic stability. The old order of the twelve-hour day must give way to a better and wiser form of organization of the productive forces of the nation, so that proper family life and citizenship may be enjoyed suitably by all of our people.

"This clear and convincing report of the engineers must prove exceedingly helpful in showing that this much to be desired result can be achieved without either economic or financial disturbance to the progress of American industry."

In effect, the engineers found that the tendency throughout the world was in favor of the eight-hour day; that the longer work day was socially unwise and not economically necessary; that more leisure for the nation's workers does not diminish their spirit of service or their efficiency, which rather it tends to promote; that the weight of evidence in industrial plants which have changed from the twelve-hour shift to the eight-hour shift is in favor of the shorter work day.

"There is a natural divergence of opinion as to the advantages and disadvantages of the three-shift operation, but the weight of the evidence and the most positive statements are in

favor of the three-shift operation," said the report. "The evidence is conclusive that the extra leisure time of the men under the shorter working day is used to good advantage."

Members of the Committee on Work-Periods, in addition to Chairman Howe, were J. Parke Channing, L. P. Alford, Fred J. Miller, and Dwight T. Farnham, of New York; Morris L. Cooke, of Philadelphia, and L. W. Wallace, of Washington. The field work was directed by Horace B. Drury, of Washington, former member of the faculty of Ohio State University, and Bradley Stoughton, of New York, chairman of the Iron and Steel Committee of the American Institute of Mining and Metallurgical Engineers.

President Harding's declaration follows that of John D. Rockefeller, Jr., who in a recent statement favored the eight-hour day.

Action of Mining Congress Causes Protest

Minority Members Against Control of Central Pacific by Southern Pacific

The recent action of the Utah Chapter of the American Mining Congress in expressing itself as being in favor of the retention of control of the Central Pacific R.R. by the Southern Pacific is being protested by the minority members, who disagree and are in favor of Union Pacific control. Similar action in favor of the Southern Pacific by other Utah bodies has been reported in these columns. A letter of protest has been sent to A. G. Mackenzie, secretary of the Utah Chapter, and copies of the statement charging that the action of the chapter was the result of a prearranged plan of those favorable to the Southern Pacific, and not indicative of full, free and open discussion of the question, are being sent to the Interstate Commerce Commission, to the Utah Public Utilities Commission, and to the Governor of Utah. The statement is signed to G. W. Lambourne, president of the Park City Mining & Smelting Co., and by J. B. Whitehill, ore-purchasing agent of the International Smelting Co. Mr. Whitehill presided at the meeting of protest. Among other things, the statement sets forth that the argument of no competition (made by those in favor of Southern Pacific control) may be set aside by freight-rate reductions made by the Union Pacific, and makes reference to the Supreme Court decision of some time ago in the matter.

Prominent Engineers Lecturing at Yale

Lectures by prominent engineers are being made part of the program of development of the engineering courses in the Sheffield Scientific School of Yale University along broader university cultural lines. These lectures will deal with the engineering profession as a whole—with its history, opportunities and obligations, and with its attitude toward public and private needs.

MEN YOU SHOULD KNOW ABOUT

Herbert Hoover is at Palo Alto, Calif.

Charles M. Schwab is in San Francisco.

Oscar H. Hershey has returned to San Francisco from Candelaria, Mexico.

R. L. Chase, of Denver, has left for Sinaloa, Mexico, on professional work.

W. Lee Heidenreich has gone to Santiago, Cuba. He will be away for a month or six weeks.

W. H. Landers is making an inspection of barytes and feldspar deposits in the Carolinas and Georgia.

J. G. Hibbs, of Denver, Colo., is making a survey of the fluorspar and manganese resources of the Southwest.

Walter Harvey Weed, of New York, mining engineer and geologist, is at Wallace, Idaho, on professional business.

Daniel Harrington, one of the Bureau of Mines' supervising mining engineers, is paying a visit to the Washington office.

James P. Porteus, superintendent of the Bonney Mining Co. at Lordsburg, N. M., is in San Francisco on company business.

J. C. Greenway, president of the Ajo Copper Co. and general manager of the Calumet & Arizona Mining Co., is in New York.

W. G. Waring, of Webb City, Mo., recently examined the zinc district of Mohave County, Ariz., accompanied by **H. B. Kinnear**, of Columbus, Ohio.

James F. McCarthy, of Wallace, Idaho, general manager of the Hecla Mining Co., attended the meeting of the directors of the company in Milwaukee on Nov. 25.

William J. Bursaw, vice-president of the Boston Montana Corporation, was in Toronto recently on his return from an inspection of the company's properties at Coolidge, Mont.

Norman L. Wimler, who has been studying placer mining methods in Alaska for the Bureau of Mines, has returned to the Berkeley station, where he will work this winter.

C. B. Marshall has been appointed instructor in mining and metallurgy at the University of Idaho, at Moscow. Mr. Marshall is a graduate of the Michigan School of Mines.

Henry L. Smyth, of Cambridge, Mass., president of the Keweenaw Association, inspected the company's Gogebic Range properties last week, accompanied by **Dudley S. Dean**, of Cohasset, Mass.

It has been announced by the Phelps Dodge Corporation that **John H. Davis**, superintendent of the Bunker Hill mines at Tombstone, Ariz., is transferred to the office of general manager P. G. Beckett, at Bisbee. **A. M. Morris** succeeds Mr. Davis. Mr. Morris has been with the corporation since 1913, when he came to the Douglas smelter from Amherst College. Later he was secretary to S. W. French, general manager, and then to Walter Douglas, president.

Fred E. Wright, of the Carnegie geophysical laboratory, who recently returned from a several months' visit on the Rand, discussed his observations at a recent meeting of the Pick and Hammer Club of the U. S. Geological Survey.

M. Van Sicklen, the assistant chief mining engineer of the U. S. Bureau of Mines, is in the tri-state zinc district advising the Indian office with regard to leases there. **E. H. Denny** will serve as assistant chief mining engineer during Mr. Van Sicklen's absence.

H. H. Colley, who has been superintendent of the reduction works of the Old Dominion Co. during the last six years, will leave the services of the company the first of the year. He will be succeeded by **D. L. Forrester**, who is the present mill superintendent.

George W. Heintz, for a number of years vice-president and general manager of the United States Smelting, Refining & Mining Co.'s metal operations in Utah, Colorado, Nevada, Arizona, and California, with headquarters at Salt Lake City, and for the last three years vice-president in charge of western operations of the same company, in Boston, has resigned, effective Jan. 1. Simultaneously Mr. Heintz relinquishes the executive office of the Sunnyside Mining & Milling Co., the Bullion Beck Mining Co., the Niagara Mining Co. and the United States Stores Co., all of which are subsidiary or affiliated companies of the United States Smelting, Refining & Mining Co. After a short vacation, Mr. Heintz will engage in consulting work in Boston.

Mining and metallurgical engineers visiting New York City last week included: **S. M. Greenidge**, of Washington, D. C.; **Henry B. Smith**, of Meriden, Conn.; **R. H. Catlett**, of Hagerstown, Md.; **K. H. Donaldson**, of Cleveland; **O. B. Smart**, of Tampico, Mexico; and **E. H. Dickenson**, of Philadelphia, Pa.

OBITUARY

William H. Brophy, of Bisbee and Los Angeles, who was formerly general manager of the Phelps Dodge Mercantile Co., was drowned on Nov. 13 when he was swept from a small boat during a heavy storm on the Gulf of California. Mr. Brophy was president of the Bank of Bisbee and was largely interested in many copper mines in the Southwest, having been one of the original promoters of the Morenci mines before the acquisition of that property by the Phelps Dodge interests.

THE MINING NEWS

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Leading Events

ACQUISITION of Chile Copper control by the Anaconda company appears to be an accomplished fact. American Brass, the largest consumer of copper and zinc; Chile Copper, owner of the largest developed deposit of copper ore; and Anaconda, the largest domestic producer of copper, are now under one control. Rockefeller interests are said to underwrite the necessary bond issue.

Centralization of statistical work at Washington would destroy value of mine production data, say western Congressmen.

Mining in eastern Washington thrives; lead-silver ore goes to Bunker Hill smelter.

Flotation and cyanide plants begin operation in northern Sonora, Mexico.

Reports say that a contract has been let for constructing a 13-mile railroad northward from Hyder, Alaska.

The Copper Queen smelter at Douglas, Ariz., is to be improved and re-equipped.

The Phelps Dodge company needs 150 miners at Morenci, Ariz.

Several new concentrators have been started in the Joplin-Miami zinc-lead district.

The Simon Silver-Lead Co. at Mina, Nev., is making rapid progress with its new shaft. Mill capacity is increased.

Anaconda Copper Buys Chile Copper

Largest Producer Acquires Control of World's Biggest Deposit of Copper Ore—Guggenheims Are Vendors—May Be Nucleus of Super-Merger Like U. S. Steel—Rockefeller Interests Underwrite Deal

ALTHOUGH at the time of writing no official announcement has been made, the purchase by the Anaconda Copper Mining Co. of 2,200,000 shares of Chile Copper Co. stock, owned by the Guggenheims, is virtually consummated. The price mentioned is $35 per share. The Rockefeller interests are said to have agreed to underwrite the bonds necessary to complete the transaction, and nothing remains to be done but to arrange the formalities.

Many profess to see the nucleus of a huge corporation like United States Steel or Standard Oil, color to this idea being added by the absorption last spring of the American Brass Co. by Anaconda. The American Brass Co. is the largest fabricator of brass (making about 500,000,000 lb. of finished material annually) in the world and as such is one of the largest consumers of copper and zinc. When the Chile deal has become a matter of history it will not be surprising to find Anaconda looking around for a few zinc mines, as it cannot produce nearly enough zinc from its mines at Butte to supply its own needs.

Aside from owning the largest known deposit of copper ore in the world, the Chile Copper Co. is the lowest-cost producing company. The deposit contains 700,000,000 tons of positive and probable ore that will average above 2 per cent copper. Mining this deposit is simple. All work is done in open-cut levels by electric shovels.

Operating at capacity, or, say, 225,000,000 lb. of copper a year, the company, on present known reserves, has a life of over 125 years—and there are alleged to be millions of tons of ore in its property not yet developed. It is this cheap copper that is today making the 14c. copper market. It is the balance of power in the metal market.

Although Chile Copper is producing at the rate of only 156,000,000 lb. per year, by next spring its productive capacity should be between 220,000,000 and 230,000,000 lb. annually—an operating objective to be attained by the expenditure of less than $1,000,000.

The fact is pointed out that, the property being in Chile, its acquisition would not conflict with the Sherman anti-trust law no matter how high an output might be attained ultimately. In addition, Anaconda owns, a few hundred miles away from Chile, the Andes property, another immense disseminated-copper deposit, not yet in the producing stage. This makes possible, later on, the putting of these two into one Chilean subsidiary.

A 50 per cent expansion in American Brass business since Anaconda acquired it the first of the year has hastened decision to acquire additional cheap future sources of copper. Another important factor is the desirability of joining to Anaconda's old properties a young low-cost current producer, so that by proportioning the amount of copper drawn from each property according to price ruling in the market, earnings can be kept fairly constant, and at the same time Anaconda's Butte deposits can be mined in such way as to give the greatest ultimate reralization. Butte copper has a geographical advantage for supplying Western markets, whereas copper from Chile can be delivered at cheaper freight cost to all American Brass plants except Kenosha.

Anaconda will take control of a company that today has 3,800,000 shares of stock outstanding, $35,000,000 6 per cent bonds maturing in ten years and $15,000,000 7 per cent bonds coming due next May. By that time the company expects to have in cash and securities between $22,000,000 and $23,000,000 with which to meet its $15,000,000 bonds. If these bonds are converted there will then be 4,400,000 shares of Chile outstanding.

New Mill in Oklahoma Costs Half of War Price

The White Mining Co., of Miami, Okla., Otis White, manager, has purchased the mill frame of the Skelton No. 6 plant and is moving it to the site of the White mill, which was destroyed by fire on Nov. 7. The contract for the new mill is $61,030, which is about 50 per cent of the cost of similar plants during the war. The framework will be covered by corrugated zinc sheeting. The sludge plant will include ten tables and three jigs, larger than those at the plant burned. The capacity will be about 350 tons per shift.

Two Sources of Relief for Colorado Zinc Mine Operators

Completion of Coolbaugh Plant and Discovery of Natural Gas May Prove Helpful

The discovery of gas in large quantities in the lower San Juan basin of Colorado is creating wide interest in connection with smelting operations at Durango. It is leading to much speculation as to whether the use of gas may not become a factor of bringing about, in the near future, substantial relief from high freight and handling charges now necessary in getting zinc-bearing ores to Oklahoma and Kansas smelters for treatment. Fuel is the principle element of cost in retort smelting of zinc ores, and cheap fuel is the big advantage of the middle states plants.

The approaching completion at the first unit of the plant using the Coolbaugh process for the simplification of the zinc-smelting problem in connection with San Juan ores, at the Durango plant of the American Smelting & Refining Co., has stimulated activity throughout the tributary territory. The addition of several heavy producers in San Juan County as soon as the new plant is in operation is forecast.

Western Union, in Coeur d'Alene, Opens Rich New Oreshoot

What appears to be a parallel oreshoot was recently discovered by crosscutting 10 or 12 ft. from the drift along the hanging wall north toward the foot at the Western Union mine, near Wallace, Idaho. There is a showing of 4 ft. of excellent lead-silver ore, 2 ft. of which is practically clean "steel" galena that carries about 60 per cent lead and 50 oz. of silver. A shoot of the same class of ore, though not so large, along the hanging wall has been stoped to a height of about 100 ft. This, until the recent strike on the foot-wall side, was supposed to have been the main and only Western Union oreshoot. The company is shipping a product made by sorting and hand jigging.

Blaylock Protests Against Anti-Fume Legislation in British Columbia

S. G. Blaylock, managing director of the Consolidated Mining & Smelting Co., at Victoria, B. C., appeared recently before the Agricultural Committee of the Provincial Legislature, now in session, to protest against the passing of contemplated legislation, restricting the pollution of the atmosphere by smelter fume. He stated that it was commercially impossible to prevent the escape of fume from the roaster into the atmosphere, and that to raise the stack, as had been suggested, meant only spreading the fume over a larger area. If the contemplated legislation were passed, he said, it would curtail the production of the smelter to 25 per cent of its present output, and would make it impossible for the company to treat custom ore.

Flotation and Cyanide Plants Start in Northern Sonora

Successful Concentration Encourages Work in Gold-Silver Districts of Old Mexico

BY R. S. CLINCH

M. B. Parker has completed the remodeling of the San Jose mill, near Nacozari, State of Sonora, Mexico, and is now treating about fifteen tons of ore daily. The method of treatment is by flotation; promising results have been obtained. An extraction of 85 per cent of the silver and 90 per cent of the gold is reported. The tailings will be stored for cyanide treatment later. This enterprise has been in the nature of an experiment and its success will mean a great deal to the San Jose and Churunababi districts; it will demonstrate that the ores from this famous gold-silver belt can be economically treated by flotation. Mr. Parker will accept custom ores in lots of fifty tons or more.

Lugo and Quiroga, of Nacozari, recently denounced the Campo Colorado mine, about 17 miles northwest of Nacozari, in the Arispe district. They plan to put in a 10-ton flotation mill and sink in the old shaft to develop the ore on depth. This mine was opened up by Jim Kirk in the 70's, and some high-grade ore was shipped from surface. A later company did rather extensive development on the vein near surface, but found no way of treating the ore economically at that time.

McKenney and Marshall are busily engaged in the construction of their cyanide mill at the fork of Cebolla and Tarasca canyons, just south of the El Globo camp. An option has been obtained on the adjoining Guadalupe del Oro mine, and a blanket denouncement, San Salvador, has been made on the south and west continuations, covering the present mill site. The old Pittsburg ground was recently taken up by McKenney and Marshall, who expect to make it a producer.

Clinch y Antunez, who took up the old La Concha mine, in the Gueriguito district, some time ago, have been doing some development work in a new shaft, and at the 60-ft. level have 10 ft. of good milling ore carrying gold, silver, and copper. In sinking the shaft several bunches of high-grade chloride ore were encountered. The shaft is now in the primary sulphide zone, having a quartz gangue with finely disseminated chalcopyrite. It is an ideal ore for flotation. Recently the continuations were denounced by the same operators.

Little Mattie Mill Nears Completion at Georgetown, Colo.

The 150-ton mill under construction at the Little Mattie mine near Georgetown, Colo., will probably be ready for operation by the first of January, when, it is reported, a large force of miners will be employed. The unwatering of the mine, which has been under way for some time, is completed to the 9th level.

Picher Company Will Use Belt Conveyor for Tailing Disposal

Time-honored Joplin System of Flumes and Elevators Will Be Displaced by Efficient Equipment

Disposal of tailings by means of conveyor belts is being tried by the Golden Rod M. & S. Co. for the first time in the Joplin-Miami zinc-lead district. Equipment is being installed at the company's No. 7 mine, and H. H. Wallower, superintendent, estimates for it a saving of at least $8,000 in two and one-half years, compared with the flume system of tailing discharge heretofore used exclusively in this field. A 20-in., 4-ply cup conveyor belt is to be used, and at the start the belt will be 200 ft. long and will rise at an angle of 18 deg. With a 15-hp. gas engine it is expected the conveyor belt will handle sixty tons of damp tailing per hour. The cost will be around $1,500, whereas a 70-ft. mill elevator and a 60-ft. dummy elevator costs about $3,000, and 60 hp. is needed for its operation.

Visit of Well-Known Engineers Puzzles Lake Copper People

J. R. Finlay and Pope Yeatman, consulting engineers, of New York, and James F. Kemp, professor of geology in Columbia University, are engaged on a "mysterious" mission at the Calumet & Hecla mines, in Michigan. The visit has aroused much speculation. The rumor is persistent that a consolidation or merger of some sort is contemplated, and that these specialists are here for the purpose of making an intimate valuation of Calumet & Hecla and its group of subsidiaries. Mr. Finlay appraised the copper and iron mines for the State of Michigan in 1911. Mr. Yeatman formerly was identified with the Guggenheim interests. Professor Kemp appraised the Anaconda mines at the time of the absorption of the American Brass Co.

Contract Let for 13-Mile Railroad From Hyder, Alaska

Charles F. Caldwell has let a contract to Seims & Carlson, railway contractors of Spokane, for a railway from Hyder up the Salmon River valley, in Alaska, to the international boundary, a distance of 13 miles. The line will serve the American Mining & Milling Co.'s Fish Creek mine, which is in an advanced state of development and nearing the producing stage, and the Daly-Alaska, Alaska-Premier, Riverside, Titan, and Virginia groups, all of which are on the Alaskan side of the boundary and all of which show promise of being developed into shipping mines. Later it is proposed to continue the line to the head of Salmon River valley.

Rhodesian Gold Production

By Cable from Reuters to "Engineering and Mining Journal-Press"

London, Dec. 2—The output of gold in Rhodesia in October totaled 54,670 fine ounces.

Mining in Eastern Washington Is Gradually Improving

Bunker Hill Smelter at Bradley, Idaho, Gets Nearly 2,000 Tons per Month from Lead-Silver Producers

Mining in eastern Washington has been stimulated by the increase in the price of lead. About 2,000 tons of ore per month is being shipped to the Bunker Hill smelter at Bradley, Idaho. Among the producers are the Electric Point, near Northport, which recently started shipments and is sending 50 tons per month. The Gladstone mine is producing at the rate of 100 tons per month, with new ore reserves being developed which may materially increase production in the near future. The Lead Trust mine is averaging a car per month, or approximately 50 tons. All the ores from these properties are shipped crude and average about 65 per cent lead and 2 oz. silver. The Washington Black Rock Mining Co., 6 miles east of Northport, a new producer which has maintained production from the grass roots, is shipping on an average of 350 tons of high-grade zinc and lead ores per month. The zinc averages 40 per cent and the lead ore 70 per cent, with small amounts of silver.

At Colville, the Dominion Silver Lead company, an intermittent shipper, averages about 20 tons of ore per month, which will be increased soon. Shipments of high-grade ore average 880 oz. silver, $3.60 gold, 19 per cent lead, and 24 per cent zinc. The low-grade ore carries 180 oz. silver, $1.50 gold, 7 per cent lead, and 14 per cent zinc. At Springdale, the Santa Rita Mining Co., operating the old Cleveland mine, is steadily producing 100 tons of lead-silver concentrates monthly. The average assay of the concentrates is 47 per cent lead and 42 oz. silver.

Near the Santa Rita, Snyder and Van Horn are shipping 30 tons of high-grade silver ore per month from the Queen mine.

The gold mines of the Republic district maintain intermittent production, depending upon the smelters to absorb the highly siliceous ores. Production has been fairly regular of late. The Surprise & Lone Pine has shipped 300 tons per month and the Quilp about 350 tons. The Knob Hill recently resumed production at approximately 100 tons per month. The Last Chance has just been unwatered and will immediately begin production at the rate of three to four cars weekly. The ores of the mines mentioned range in value from $12 to $20 per ton.

Developments in Nigerian Tin Fields

By Cable from Reuters to "Engineering and Mining Journal-Press"

London, Dec. 2—The Tin Fields of Northern Nigeria, Ltd. (London), contemplates further developments on its property in Northern Nigeria, comprising the installation of a new plant consisting of gravel pumps, oil engines, sluice boxes, monitors, piping, and sundry other equipment.

Copper Queen Smelter Will Be Remodeled

Plant at Douglas, the Largest in Arizona, Needs Modernizing

Work is about to be started on the remodeling of parts of the Copper Queen smelter at Douglas, Ariz. Improvements are planned, it is reported, that will reduce materially the cost of operation.

The present system of bedding pits in which the ore is mixed with steam shovels and thereafter lifted into the cars that take the mixture to the smelter feed floor is to be abandoned. Instead, the ores and flux are to be mixed by belt conveyors, probably at the mines, with gravity taking the place of the shovels.

The Copper Queen smelter, the largest in Arizona, was built twenty years ago and, though partly reconstructed from time to time, it is not entirely modern. It handles not only ores from the Copper Queen group at Bisbee, but also concentrates from the company's Clifton branch and from the company's new Moctezuma mill at Nacozari, as well as custom ores from the Tombstone, Courtland, and Patagonia.

There may be need for more reverberatory furnace capacity as soon as the new Copper Queen 4,000-ton mill is in operation at Don Luis, near Bisbee. It is understood also that a lead-silver furnace is to be included in the new plant, for there are large offerings of silver ore from Patagonia and Tombstone.

News from Washington

By PAUL WOOTON
Special Correspondent

Vigorous Opposition Expressed to Centralization of Government Statistical Work

Western Congressmen See Serious Detriment to Mining Industry in "Mass" Production of Statistics

REVIVAL of reports that action toward reorganization of administrative departments of the Federal Government will be sought before the present Congress expires in March has brought opposition to some of the suggested changes bristling to the front. Among the suggestions certain to meet opposition is the centralization of all statistical work of the government in a single bureau.

Members of Congress from mining districts are among those who view this proposal with disfavor, fearing that the valuable work that has been done in compiling and interpreting statistics on mining operations and mineral resources might, by centralization, become mere compilation and lose the highly important character of interpretation. This group is not alone in opposition to consolidation of the government's statistical work.

It may be that the proposal will be put forward in such light that it would win converts from the opposition in sufficient numbers to assure its adoption by Congress. The plan in detail has not been made public in official form. The opposition has received its information largely from newspaper reports. There is considerable doubt that any action whatever will be taken on a reorganization plan during the life of the present Congress, yet the effort would not be surprising in view of persistent rumors and the known desire of the Administration to eliminate obvious duplication of effort in some of the administrative departments.

As the situation stands, consensus of opinion among Congressmen from mining districts appears to be that there is no duplication of major statistical work relating to minerals and that there should be no change in practice at this time. This work is now handled by the Geological Survey. If a Department of Mines were to be created, as has been suggested, the Survey would be transferred to it and the work would proceed without interruption.

The contention of those opposed to the suggested centralization of statistical work is that at present the figures of mining and mineral resources are presented with interpretations which enable the industry to grasp their significance and to guide its development and future activities.

Interpretation of the data, it is pointed out, requires a critical co-ordination of the qualities of an economic geologist—combining those of geologist, engineer, and political economist. The fear is expressed that this production of various statistics through a centralized bureau might lead to the elimination of one of these elements which up to the present have proved valuable in aiding the mining industry to direct its energies intelligently.

Will Survey Potash Resources

With the purpose of keeping all of its potash research co-ordinate, the Bureau of Mines has assigned Dr. Andrew Stewart, of its staff, to the work of making a survey of the present conditions of the eighty-eight potash permits outstanding. Dr. Stewart has been studying potash production in this country and its possibilities. It is believed that present investigation will be aided by his temporary assignment to the leasing work.

Geological Survey and Bureau of Mines Get $3,358,790 as 1923 Budget

Increased Appropriations as Compared with 1922—More Money for Mine Accident Investigation—Lease Supervision Expands

THE Director of the Budget has approved proposed expenditures of $3,358,790 to be used during the next fiscal year by the U. S. Geological Survey and the Bureau of Mines. The greater part of that sum will be expended on work of direct concern to the mining industry. The budget carries $1,576,090 for the Geological Survey and $1,782,700 for the Bureau of Mines. In each case this represents an increase over the amounts appropriated for the current fiscal year. The principal items proposed for the Geological Survey are as follows:

For the preparation of reports on the mineral resources of the United States, $124,250; for geologic surveys, $351,900, an increase of $51,900; for the clerical staff, supplies, traveling expenses and printing, $324,500; for chemical and physical researches, relating to the geology of the United States, $40,000; for preparation of illustrations, $18,280; for work on the mineral resources of Alaska, $75,000; for engraving and printing geologic maps, $110,000; for gaging streams and determining the water supply of the United States, $179,500; and for the classification of lands, $300,000, an increase of $75,000.

The principal items comprising the appropriations of the Bureau of Mines follow:

For mining experiment stations, $175,000, an increase of $5,000; for mineral mining investigations, $125,000; for investigations of mineral fuels, $146,000, an increase of $10,000; for operating mine rescue cars, $211,000; for investigations as to the cause of mine accidents, $393,000, an increase of $15,000; for clerical help and general expenses, $78,700; for inquiries and investigations, and dissemination of information concerning the mining, preparation, treatment, and utilization of petroleum and natural gas, including economic conditions affecting the industry, with a view to economic development and the conserving of resources through the prevention of waste, for enforcement of the Leasing Act, for enforcement of laws relating to leases on Indian lands and naval petroleum reserves, $485,000; for supervision of coal and mineral leases, $45,000; for mining investigations in Alaska, $35,000; for the purchase of seventy-eight acres of land at Bruceton, Pa., now occupied by and adjacent to the buildings and equipment of the explosives-testing station and experimental mine of the Bureau of Mines, together with ten acres of unmined coal, $33,000.

The budget includes substantial additions to cover the leasing work being done by the Bureau of Mines. This includes the expense of furnishing technical supervision over leasing on Indian lands. This responsibility has rested with the Bureau since Secretary Fisher's day, but it was necessary to take from other appropriations for this work. The need of making this inspection more systematic has become apparent, and a special fund is being asked.

An increase has been allowed so as to permit the purchase and operation of equipment for investigating liquid oxygen. Another increase provides for the study of a classification of coals according to their use.

In addition, it is expected that other substantial sums will be available to the Bureau on transfer from the Navy for work on naval petroleum reserves and from both the Army and Navy for work on helium and for testing explosives.

The appropriations asked for, but not allowed by the Director of the Budget, include that providing for a field testing station for oil-shale work and for its operation for the first year. The Director of the Budget also reduced the amount requested for the Bureau's leasing work, and it probably will be necessary to ask for a deficiency appropriation, especially for the coal-leasing work. To meet that emergency, the Secretary of the Interior has authorized the temporary transfer to the Bureau of Mines of several of the field agents of the Land Office.

No appropriation was asked for new mine rescue cars. The cars appropriated for last year are nearing completion and will be available for service after the first of the year.

The government fuel yard is now operating on a basis which will permit of a reduction in the revolving fund from which coal purchases are made. This reduction was requested by the Bureau.

Arsenic Production Will Be Investigated by Congress

Aroused by complaints of constituents that the price of calcium arsenate has advanced rapidly and that the supply is short at any price, members of Congress from the cotton belt, where the compound has proved to be the most effective poison in general use to combat the ravages of the boll weevil, have taken action toward an investigation.

Senator Harris, of Georgia, has written both the Department of Justice and the Federal Trade Commission asking them to investigate whether there exists a combination to control the price of white arsenic, the base of this compound. Representative Wise, of the same state, has introduced a resolution in the House directing the Federal Trade Commission to report the cost of manufacturing and producing calcium arsenate and whether the production and prices are controlled by any unlawful combination. Senator Smith, of South Carolina, has drawn a Senate resolution declaring that a crisis exists for agriculture because of the difficulty of obtaining arsenical insecticides and directing the Department of the Interior, through the Geological Survey, to investigate the supply of white arsenic and possible development of new sources of supply.

Pyrite Producer Gets $12,461 on Reconsidered Claim

War Minerals Commissioner Recognizes Stimulation Based on President's Message

An award of $12,461.64 has been recommended to the Secretary of the Interior by the War Minerals Relief Commissioner in full settlement of the claim of the Arizona & Georgia Development Co., of Temple, Ga. The former War Minerals Relief Commissioner held that this claimant could not base government stimulation on a request by S. W. McCallie, the state geologist of Georgia. That commission held that he was not an authorized agent of the Federal Government. Commissioner Robinson, however, gives weight to the request of Mr. McCallie that the claimant make every effort to produce pyrite. Under the amended act, however, the claimant is able to establish stimulation based on President Wilson's message, issued prior to the opening of work on the property. Commissioner Robinson makes a deduction of the amounts expended in efforts to produce copper. Copper occurs in connection with the pyrite. The claimant during a portion of the operation attempted to recover the copper by a precipitation method. Other awards recommended by the commissioner are as follows:

Washington Chrome Co., Seattle, $1,078.47; Edwin L. Freeman, Latrobe, Calif., $225; Corliss & Peacock, Grants Pass, Ore., $346; J. A. Shields, East Auburn, Calif., $186.20; George E. Brown, Roseville, Calif., $251.

Disallowances were recommended as follows: Red Mountain Chrome Mining Co., Eureka, Calif., not within the act; Whitcomb & Lydig, Philipsburg, Mont., net loss not established; J. H. Cooke, Milwaukee, not within the act; C. F. Irish, Georgetown, Calif., not within the act; M. A. Delano, San Francisco, additional award not justified; Casey, Brown & Saunders, Batesville, Ark., commercial importance not established; John F. Perkins, St. Thomas, Nev., not within the act; Chandler & Haight, Canyon City, Ore., not within the act; Liberty Mining Co., San Francisco, loss not established; William Osborne Houck, Atlanta, additional award not justified; Sixte Choix, Latrobe, Calif., stimulation not established; F. S. Mackie, Seattle, not within the act; S. O. Nelson, Boise, Idaho, loss not established.

Only 63,000,000 More!

Purchases of silver by the Bureau of the Mint during the week ended Dec. 2 amounted to 2,166,000 fine ounces. This brings the total purchases under the Pittman Act to 144,768,412 fine ounces.

News by Mining Districts

By Special Correspondents in the Field

London Letter

Reforms of Management and Labor Indicate Brighter Future on the Rand

By W. A. Doman

London, Nov. 24.—Perhaps the most striking feature in the annual report of the New Consolidated Gold Fields is the admission of a certain laxity of conditions which had prevailed on the mines of the Rand previous to the strike early in the current year. To outside critics it was long known that labor, both white and black, was wasted. This state of things has existed for years; in fact, it was a scandal at some mines. But for some unexplained reason it was allowed to continue.

Before the war I was told of a group of mines where the underground men were always in one another's way, and that in consequence the properties could not be worked economically. Hugh F. Marriott, when with the Central Mining Corporation, could see where labor was wasted, but even he could not make headway in effecting a reform.

Another admission in the Gold Fields report is that the functions of the mine manager had been taken over by the Chamber of Mines. This also was a point that Hugh Marriott was up against. And not only he. Some of the leading officials on the Rand a few years ago spoke and wrote, though only privately, very strongly against the transfer of power from the mine manager to the Chamber. It has never been stated in print who let the managers down and built up a bureaucracy, but the policy has proved bad from every point of view. The report of the Consolidated Gold Fields shows that already matters have improved. The mine manager knows his men and should be allowed to deal with them. Reversion to the old practice shows that not only is there more sympathy between manager and men, but no time is wasted in appeals to the Chamber of Mines.

The report mentions specific cases of mines belonging to the Gold Field group where not only is there now greater efficiency, but costs are materially reduced. The reduction is due mainly to lower wages, though a further falling off in the payroll has also contributed by abolishing some redundant labor. Though a fall in the price of gold was a few months ago viewed with alarm, seeing that it meant, under old conditions of working, the closing down of a larger number of mines, the position is now quite different, and longer lives for the various properties are predicted.

Under the new conditions, resulting from the riots in the first three months of the year, the activities of the labor unions have been checked. For the whole of the Rand, the working costs per ton were 21s. 1d. in July last, as compared with 25s. 7d. in July, 1921. Individual mines give even more striking results; and as regards the field as a whole, D. Christopherson says, "The prospects are today much brighter than has been the case for many years past."

Though the Gold Fields had to write off £147,013 for depreciation during the twelve months ended June 30 last, it earned an income from dividends and profits realized by sales of investments of £379,376. The foundation has also been laid for new and it is hoped profitable business which should take form during the current year.

Johannesburg Letter

"New Rand" Is Still Far From Realization—Some Gold Found

By John Watson

Johannesburg, Oct 31—On the farm Goedgevonden, in the Potchefstroom district, a diamond mine is being tested and worked. This mine is quite near to the old Buffelsdoorn gold property. One 30-carat diamond has been reported in an early wash. Machinery has been laid down by a syndicate, which means to test the ground thoroughly. The late J. H. Wilson, two or three years ago, superintended a good deal of prospecting and drilling on the farm Droogesprint, not far from Machavie station.

Rumors have been current, for some months, of the discovery of rich gold fields—of "a new Rand," according to some—running for 80 to 100 miles, from the northern part of Rustenburg district into Bechuanaland (near Mochudi). The district has recently been visited by Owen Letcher, a well-known mining journalist, and a series of articles from his pen have appeared in *The Star*. The new reef appears to be a pebble bed conglomerate, or "blanket," occurring in the Ventersdorp formation, and is traceable, more or less, from the Bechuanaland border to the Nylstroom district. There appear to be two reefs, known in the district as the Batavia and the Smaldeel series, and these run parallel at a distance of 10 to 14 miles apart. Among local farmers who have taken a leading hand the brothers Pretorius must be mentioned. The homestead and store of Christoffel Pretorius, on Laatstepoort, is the preliminary objective, by those visiting the proclaimed farms, Batavia and Kameelboom. Wessek Pretorius was the discoverer of the new auriferous line on Batavia. In his latest article, Owen Letcher points out that a great deal of development work is still necessary and that, so far, profitable values have not been established over a stoping width for a sufficient distance to warrant the erection of even small stamp mills.

Montreal Letter

Lowisohns Encouraged at Goldale—Power Shortage Becomes Monotonous

By Alexander Gray

Montreal, Nov. 30—Drifting on the 500 level, the understanding is that a vein 12 ft. in width and carrying satisfactory values has been picked up in the Goldale. Should lateral development confirm anticipations of Manager Kee, who is directing the work in behalf of the Lewisohn people, Messrs. Poillon & Poirier, mining engineers of New York City, will be entitled to a complimentary mention, at least. The Goldale, on the eastern axis of Pearl Lake, is the last of the so-called Pearl Lake section—excepting the Platt Veteran claim—to undergo development. Originally, the Bewick, Moreing interests took it over, along with a collection of claims, from individual Hollinger owners and others. The ground was drilled and prospected to some extent. Ernest Williams, then in charge of Bewick, Moreing field operations at Porcupine, felt the area had more than a chance, owing to geological conditions and values obtained at the outcrop. However, the London interests folded their tents, departed, and eventually Ex-Minister Gerard and others were enlisted by T. H. Rea. Messrs. Poillon & Poirier recommended drilling. They found outcrops of an encouraging character, and the drill intersected several veins. Moreover, a porphyry section in contact was an added inducement. Near by, the Plenaurum company had a small high-grade vein, but the shoot was short—and working capital equally so. An extension of the Pearl Lake section to the east would be a disappointment only to those who took it for granted they were out of it. For ten years there was no movement between the Goldale and the Dome Lake.

Under the auspices of Homer X. L. Gibson, the Pawnee property, in southeastern Lebel Township, Kirkland Lake district, has been financed on an exploration basis, George Gray being in charge. This is regarded as one of the most likely prospects in that section, the outcrop conditions being identical with those of the Kirkland Lake area.

Producing gold companies of Porcupine and Kirkland Lake, owing to the hydro-electric power failure, resorted to their auxiliary steam plants. Those of them without such auxiliaries are sorely disappointed, for they counted on making outputting records. There is outcry at official indifference. If hydro power is so inadequate for the present, provision for the future suggests broader treatment than has been prescribed. Porcupine power consumption is about 15,000 hp., 9,000 of that by Hollinger Consolidated, 3,600 by Dome Mines, and 1,800 by McIntyre. Ultimately, Hollinger will need 16,000. With an increasing number of non-crushing companies clamoring for power—the cost of steam being prohibitive—the gold mining industry as a whole is demanding redress

MEXICO

Two Railroads, One Finished, the Other Proposed, Will Help Mining

Chihuahua—It is said that from five to six hundred men will be employed next month in the Adargas mines, situated about 15 miles from Jimenez, in the southern part of this state. Large orebodies have been opened during the last year, and regular shipments will be made to the smelters. These ores are of gold, silver, and lead.

A number of new buildings have been erected and modern machinery has been installed. This machinery is to be moved by electric power derived from the Boquillo power plant at the big Santa Rosalia dam. Almost 50 miles of power line has been erected between the mines and the power plant. A 14-mile railroad has been constructed for conveying the ores to Jimenez station, where it connects with the main line of the National Railways.

Pachuca—According to a recent report by J. Aurelio Garcia, inspector of mines, about 800 miners are employed at the Purisima Concepcion mines of Real del Monte, State of Hidalgo. These properties belong to the Cia. Real del Monte y Pachuca, and are controlled by American capital.

Alamos—Amos J. Yeager is in Mexico City in connection with the construction of a new railroad from Navojoa to Yavaros, in the State of Sonora. Such a railroad would revive the mining industry in the Alamos district and also be of great benefit to the region around Sahuaripa and in the western part of the State of Chihuahua. It would give railway communications to the coast for the prompt transportation of machinery and supplies to the mines and ores and metals therefrom. The ores from this section are shipped largely to the Selby company, at San Francisco.

The branch line from Alamos to connect with this new road would probably revive operations of the Zambona Development Co., Quintera Mining Co., Santo Domingo Co., Cia. Minera Ibarra, Cia. Minera del Rio Mayo, La Dura Mining Co., and the Fundicion del Pacifico. It is proposed to erect a 300-ton smelter on the line of the Alamos-Navojoa-Yavaros railroad for treating the low-grade ores of the Alamos camp and others in that vicinity.

OREGON

Iron Dyke and Bay Horse Are Shipping

Homestead—The Iron Dyke mine has resumed production and is producing about 1,200 tons of crude ore and 800 tons of concentrates per month. The ore averages 5 per cent copper and $12 gold per ton.

The Bay Horse mine is a new producer in the eastern Oregon field and has maintained a steady output of ore since last May. The present rate of shipments is about 700 tons monthly, and the average value per ton is about $40 in silver. Shipments are made to the Bunker Hill smelter.

CALIFORNIA

New Dredge Launched—California Rand Silver Dividends Total $2,118,400

San Francisco Correspondence.

Redding—The Lewiston Dredging Co. launched its new dredge on Trinity River on Oct. 31, and expects the dredge to be in operation by Jan. 1, 1923. A substation is being constructed by the Pacific Gas & Electric Co. for the new dredge. The Paddon property adjacent to the Foster ranch, on the Trinity River, is being examined by the company, two Keystone drills being used in the preliminary work under M. A. Senger, engineer for the company.

Lawrence Gardella has acquired additional dredging ground west of his present holdings on Clear Creek near Redding.

The Stauffer Chemical Co., of San Francisco, has acquired the Summit group of claims in the vicinity of the Mammoth mine.

Nevada City—The Eagle Bird, at Washington, is being reopened. The Red Ledge property claim, it is expected, will be reopened. Active mining is in progress at Willow Valley, Quaker Hill, and You Bet.

Sonora—At the Columbus mine, near Tuolumne, cement gravel and float quartz is to be crushed in a 10-stamp mill.

The Belmont-Shawmut company is operating at full capacity, and development at depth is showing satisfactory results.

Mariposa—The Mount Ophir mine was recently examined by F. T. Maguire. At Chinese Camp, the National mine is being opened, and a strike of gold ore was made recently.

Los Angeles—A conference was held on Nov. 23 in Los Angeles between representatives of the Southern California Iron & Steel Co. and the Pacific Coast Steel Co. The object of the meeting was the merging of the existing steel companies with the Pacific Coast Steel Co. No definite plans were announced.

Randsburg—The California Rand Co. will increase its mill capacity from 200 to 400 tons per day. The company has declared its regular monthly dividend of 2c. and an extra disbursement of 10c. per share, bringing the year's dividends to $1,049,000 and the total dividends to $2,118,400 since incorporation.

The shaft of the Belcher Extension is well below the 100 level. The Ben Hur Extension, Dividend, and other properties are active.

Camptonville—The Mount Alta mine, which is southeast of the Sleighville House and eight miles from Camptonville, has been bonded to George F. Dyer and associates, of San Francisco. They have taken a three-year bond on the property, and plan to drive the tunnel ahead for a distance of about 3,000 ft. and then breast out the channel from this tunnel. C. N. Chatfield, one of the owners, will be in charge of the mining operations.

ARIZONA

Phelps Dodge Company Wants 150 Miners at Morenci—Schools Green Men

Kingman—The United Eastern company is preparing to prospect at depth by means of diamond drilling. A drill station is being cut on the tenth level, which is 1,300 ft. below the surface, at the breast of the crosscut into the hanging wall. The drill will be directed at an angle and will be driven 2,000 ft., cutting the vein about 2,700 ft. below its apex.

At the Telluride mine, on the 600 level, new ore has been encountered that is 4 ft. wide; drifting is to be continued to a point under a winze which was sunk in ore 9 ft. wide and assaying $35 gold. This company is now shipping 35 tons of ore per day to the Tom Reed mill.

Bisbee—The Ivanhoe Copper Co. has begun the sinking of a shaft on its property, which is just north of Warren. This company was promoted and is managed by M. J. Elsing. He proposes to sink the shaft to a depth of about 300 ft. and then to drive crosscuts to intersect some favorable looking veins that outcrop on the claims.

Globe—The Old Dominion company has purchased the Even Up claim and an interest in the Horseshoe claim from the Doyle estate. The workings of the Old Dominion mine are stopped just at the side of this property on some of the lower levels, and it is known that valuable ore occurs within the vertical lines of these claims. This will be opened, and a search will be made for other shoots.

Morenci—Although there are now 500 men at work in the Morenci mines of the Phelps Dodge company, manager J. P. Hodgson has announced that his company is in need of 100 to 150 miners. To relieve this shortage a school for miners has been established and green men are being trained under those experienced.

Prescott—A verdict for the plaintiff has been granted by the superior court in the suit brought by R. E. Moore, trustee for H. W. Lewis, et al., against the Arizona Jerome Copper Co., of Jerome, to quiet title to the Apex group of claims near the United Verde property. A similar suit has been brought against the Verde Central Mining Co.

Jerome—The Calumet & Jerome Mining Co., of Jerome, has suspended all development work. Some excellent showings were revealed during exploration, which was carried out under the direction of Arthur Whitely.

The Iron Cap Copper Co. recently has completed the installation of a new ventilating fan, of 65,000-ft. capacity, at the Williams shaft. This equipment provides the Iron Cap mine with an independent ventilation system, whereas previous to its installation air was supplied by a fan in the Arizona Commercial mine and operated jointly by the two companies.

IDAHO

Idaho Continental Is Making 66 per Cent Lead Concentrate

Port Hill—The most prominent producer of Idaho outside the Coeur d'Alene district is the Idaho Continental Mining Co., near here. Production averages 800 tons of lead-silver concentrate per month. The average assay of the product is 66 per cent lead and 26 oz. silver per ton. The concentrates are transported over mountain roads 26 miles to Port Hill by means of caterpillar tractors and trailers, whence it is shipped to the Bunker Hill smelter.

Talache—The Talache Mines Co. is maintaining production at the rate of 160 to 170 tons of concentrates per day. The average grade of the concentrate is 183 oz. silver, 1.67 oz. gold, 7.3 per cent lead, and 6.5 per cent copper. On the payroll are 240 men, employed in both mine and mill. The concentrate is sent to the Tacoma plant of the A.S.&R. Co.

Hailey—The Wood River mining district is showing more activity than for many years. The camp produced heavily in high-grade ores in the late 80's and early 90's. Since then small operators have been trying to locate the extension of orebodies dislocated by a series of flat faults. The Bunker Hill Mining Co. has started systematic operations on the Bullion and Minnie Moore properties to explore the region beyond and below the faults. The Federal Mining & Smelting Co. is now operating the Independent mine through the North Star tunnel and milling the ore at the Star plant. The Mascot mining company has erected adequate surface plant for extensive exploration well beyond the area of the more intense operations at the foot of Mount Hyndman, and plans continuous work during the winter.

Wallace—At a conference held in Wallace on Nov. 22 between the directors of the Callahan Zinc-Lead Co. and a committee representing the minority stockholders of the Galena Mining Co., the majority being held by the Callahan company, an agreement was reached through which Callahan will absorb the entire issue of Galena on a basis of fifteen shares of Galena for one share of Callahan. This agreement was unanimously ratified by Galena stockholders the following day. The plan is to finance the Galena mine, which has reached a point that will soon require expenditure for a mill and other equipment and development. The Galena is a lead-silver mine, producing no zinc, and is situated about two miles west of Wallace.

At a depth 2,000 ft. below the collar of the shaft and fully 3,500 ft. below the apex of the vein, the Hecla orebody is larger and richer than on the upper levels. The management of the Hecla is now preparing to sink 200 ft. further, or to what will be the 2,200 level. For this purpose an order has been placed with the Coeur d'Alene Hardware & Foundry company, at Wallace, for the building of a 150-hp. electric hoist which will be placed on the 2,000 level and will be ready for delivery in about sixty days.

UTAH

Mining Interests Advocate Creating the Position of State Geologist

Salt Lake City—The mining committee of the Utah Chamber of Commerce is forming a subcommittee, which is to put before the new state legislature the need of an official, such as a state geologist, who will have in especial charge the interests of the mining industry in Utah. The committee, consisting of B. N. Rickard, H. M. Adkinson, and Elias S. Woodruff, will draw up a pamphlet in which will be set forth reasons for establishing an office of state geologist.

Bingham—The report of the Utah Copper Co. fro the third quarter of 1922 shows costs of 9.58c. per pound of copper produced before credit for gold and silver; and 8.59c. a pound over these credits, as compared to 11.5c. the quarter preceding—the lowest costs since 1916, when average costs were 6.19c.

WASHINGTON

Magnesite Operations Are Being Resumed

Chewelah—The Northwest Magnesite Co. is employing 150 men, of whom 75 are engaged in dismantling the Cottrell plant of the Northport Smelting & Refining Co., which was recently acquired by the magnesite company to be used in its operations at the Chewelah calcining plant. The rest of the men are employed in overhauling the rope tramway from the quarries to the plant, and in putting the quarries in condition for immediate resumption of production. It is the company's intention to start partial production and gradually to increase output to capacity. Under the latest tariff schedule the margin of profit is said to be so small that every item must be cut to insure a profit. When operating at capacity the plant employs several hundred men and adds materially to the prosperity of Stevens County. As matters now stand it is claimed to be impossible to compete with foreign magnesite in the Eastern steel mills, but hope is entertained that proper presentation of the case to the railroads will result in a material reduction of freight rates.

Colville—A recent strike of silver-lead ore is reported by W. E. Seeley, manager of the Consolidated Silver Mountain Mining Co. operating the old Daisy mine, on the Huckleberry divide. The company recently started diamond drilling on the 400 level, and at 45 ft. from the collar of the first hole the drill entered high-grade silver-lead ore. Indications are that the oreshoot is 10 ft. wide and is the same as that on which stoping was done on the upper levels.

NEVADA

Simon Silver Lead Is Rushing Shaft Sinking—Mill Capacity Increased

Tonopah—Reports from the Tonopah Extension mine are to the effect that the orebody now being developed on the 1,880 level of the Victor shaft is the largest and most important in the history of the mine, and will likely compare favorably with the bonanza orebodies found in the Mizpah and Belmont mines in the early days of the camp. Mill capacity is to be increased from 400 to 500 tons per day.

The new vein recently discovered on the 400 level of the West End Company's Ohio shaft workings has been picked up from the 500 level and a raise started in ore. So far as developed this vein maintains a width of 6 to 12 ft. of mill ore.

Mina—The new shaft of the Simon Silver Lead Mines Co. is 425 ft. deep, and work is being rushed as rapidly as possible in order to be able to resume milling. About 1,800 tons of zinc concentrate has been sold to the Anaconda smelter at Great Falls, Mont. This concentrate contains 43 per cent zinc, 6 per cent lead, and 6 oz. silver per ton. P. A. Simon, president of the company, has issued a very optimistic letter to stockholders regarding the future. This letter states that since the mill was closed down, due to the unsatisfactory condition of the old shaft, the mill capacity has been increased from 180 to 250 tons per day, that it will be possible to handle a maximum tonnage of 1,000 tons per day through the new three-compartment shaft when completed, and that mine conditions are excellent. A large tonnage of low-grade ore has been developed during the shutdown period without approaching the limits of the orebody. It is hoped to have the shaft completed and the necessary underground connections made by next February.

About twelve men are employed at the Mabel mine, 20 miles from Mina, which is being operated by the West End Consolidated Mining Co. Regular shipments of two cars of ore per month are being made. The vein has been picked up on the 300 level, and drifts are being driven easterly and westerly in ore of good grade.

Battle Mountain—The 100-ton flotation plant of the Hilltop Nevada Mining Co. will be ready for operation in January. An ore pass from the main haulage tunnel to the developed orebody, a distance of 435 ft. on a 65 deg. slope, should be completed at about the same time. The company has 50,000 tons of ore blocked out which will average approximately $20 per ton.

The Betty O'Neal 100-ton flotation plant is operating steadily. The first carload of concentrate was shipped on Nov. 21. Mine conditions are said to be excellent. Development work has been started on a vein which was cut while driving the main haulage tunnel. A raise on the vein encountered good ore above the back of the tunnel.

SOUTH DAKOTA

Mica, Lepidolite, Beryl, and Lithia Ore Will Be Shipped

Custer—The Rare Minerals Co. is operating its property two miles east of here and production of plate and scrap mica is being made. While the property has been worked by open cut, a new shaft has been started. This will be sunk to a depth of 100 ft., and the mine will be opened to larger production. W. W. Olds is in charge of the work.

Keystone—The Maywood Chemical Co. is making regular shipments of lithia ore to the company's plant at Maywood, N. J. Diamond drills will be employed at the property to determine the extent of the deposit, and the work is to start soon.

Work is being continued by Henault & Co. at the Bob Ingersoll mine, and deposits of lepidolite, mica, beryl, and lithia ore have been developed. Regular production is assured.

Lead—The Homestake management has announced that dividends will be increased to 50c. per share beginning with the November distribution.

Deadwood—Excavations are being made for a one-unit plant of 50-ton capacity at the property of the Cutting Mining Co. The arrangements will be such that additions can be made and the capacity increased as it becomes necessary. Oil flotation is to be used.

COLORADO

Railroad Difficulties Serious at Ouray—Wages $4.50 for Miners

Ouray—Railroad car shortage is still acute and is a handicap to local mining operations. The regular producers not only have some difficulty getting in supplies, but have been unable to ship ore and concentrate. This has resulted in an accumulation of product in considerable quantity. Concentrate has been stored at the mills and has been also brought to town and dumped in warehouses, so that it will have to be reloaded and hauled to railroad. The car shortage is due to the inability of the D. & R. G. W. railroad to keep sufficient locomotives in repair to bring in empty cars. Wages throughout the San Juan were reduced 50c. some time ago. but were increased by that amount in October, making the pay for drill runners $4.50 per day.

Active preparations are going on at the Revenue mine for a winter of exploration and development. The plant and buildings are being reconstructed, the old power plants run by water power are being abandoned, and a new compressor is being installed. Thomas H. Woods, of Camp Bird, is in charge.

The Atlas and Mountain Top continue steady production. The Atlas is putting its new mill machinery and mine equipment into operation and is increasing tonnage. Leasers at the Barstow and Bachelor mines continue exploration and development, and constitute the only leasing operations of consequence.

Silverton—The Sunnyside Mining & Milling Co., operating the Sunnyside mines, at Eureka, have now about 100 men employed and is increasing the force as fast as men can be procured and the development work justifies. The mines ranked when they closed down in 1921 as among the largest producers of lead and zinc ores in Colorado. The output was about 400 tons daily. The mill was a pioneer in selective flotation and is considered one of the most modern and up-to-date plants in the state. No statement has been made as to when the mill will be put into operation.

The Melville Mining & Milling Co., which recently resumed operations on the Iowa-Tiger, is making a good tonnage of lead-silver ore, and recent developments insure prolonged operation.

The railroad situation is somewhat improving, but there is still much delay in moving ore to the smelters. It is reported that the American Smelting & Refining Co. has half a million dollars worth of bullion tied up in narrow-gage cars between Denver & Rio Grande terminals.

JOPLIN-MIAMI DISTRICT

New Mills Are Started North of Miami

Miami—The Eagle-Picher Lead Co. will start its Goodwin mill in the near future. It is the last of the company's seven mills to be put into operation after the shutdown of a year ago. It is of 400-ton capacity, and will give employment to about 150 men. It has been down eighteen months.

A tract of land two miles southeast of Hockerville is being drilled, with indications of a well-defined orebody, by C. E. Gordon, Ralph Chambers, W. C. Harp, and others. This is the first promising drilling thus far to the east of Hockerville, except in Sunnyside.

A new shaft has been completed at the Lucky Syndicate mine, about 1,500 ft. west of the mill, and a gasoline locomotive is being used to haul dirt from it. A new boiler has been installed at the shaft, for the hoists. The mine is being put at double shift. Leon Childress is superintendent.

The Butte-Kansas Mining Co. has started up its No. 1 property at Waco, after an idleness of about eighteen months. The company also owns the Acme mine, in the Waco field, known as its No. 2, which has been producing about a month. Together the company has five shafts in active use, one having been just recently completed. It can produce about 1,000 tons of dirt per day. L. P. Buchanan, of Joplin, is managing director of the company.

The American Zinc, Lead & Smelting Co. is marketing about 200 tons of calamine from Treece every week. The ore is mined by sublessees, mostly small operators, on the company's lands at this place.

MICHIGAN

Rock Too Rich to Drill Is Encountered in New Baltic Shaft

Houghton—The Copper Range company temporarily suspended mining operations in the Trimountain mine on Dec. 1, and the 200 miners employed were transferred to the Champion. The number of men underground at the two properties warranted only the operation of the Champion. The Baltic will continue as usual. The Champion is the largest and richest of the group of three. Development work will continue in No. 2 shaft, Trimountain, and the construction of the new steel and concrete shaft and rock house now under way at this shaft will continue. The structure should be completed and ready for use by spring. By concentrating mining work in Champion and Baltic until such a time as the labor situation improves, there will not be such a spread of costs, and more copper per man employed underground will be possible.

Copper rock so rich that drilling is done with difficulty is being encountered in the south drift at the 1,250, or bottom, level of the New Baltic shaft of Arcadian Consolidated. This opening is in 230 ft. from the shaft. The last few cuts have been in ground heavily charged with copper, mostly barrel work, the showing being equal to that on the level above. The vein matter now being cut is a continuation of the rich shoot encountered on the 1,100 level. The drift to the north, now in 170 ft., continues in good stamp rock. Drifting both north and south will continue.

Mayflower-Old Colony plans to pursue its present program of development. The company is working only a small force, and on the present basis of operations has sufficient funds to last fully another year. At present shaft repairs and a general overhauling of equipment are under way, opening work having been temporarily suspended. Repairs will require two or three weeks. On the 1,700 level, the crosscut which has been proceeding southeast along the strike of the Mayflower bed will be continued to provide the geological data on which to base future development. This opening is now in trap after passing through 170 ft. of commercial rock. On the 1,400 level, the east crosscut, in 400 ft., will be continued toward a copper-bearing area that some time ago was tapped by the diamond drills.

North Kearsarge and other Osceola shafts are being kept in repair, and this sort of work will continue at the property wherever necessary throughout the winter. This will make it possible to resume operations without delay in the spring if labor and metal-market conditions warrant that step. The North Kearsarge branch, the most productive part of the mine, is in splendid physical condition. No. 1 shaft has been retimbered throughout, and new electric pumps are keeping the shaft dry.

The Situation at the Mines

By Arthur B. Parsons
Assistant Editor, *Engineering and Mining Journal-Press*

THE NEAR APPROACH of real winter weather has had a stabilizing effect on the mining industry. Prospecting generally has been suspended, and many small operations in outlying districts have been discontinued, thereby releasing some miners; most of the underground workers who can be expected to return to the mines from summer pursuits have done so. As a consequence producers know about where they stand with respect to labor supply. In most districts the companies report that they could use more miners to good advantage, but, as there is little likelihood of getting material additions to present forces, programs are being based on the number of men now available.

Production in the aggregate is at a somewhat higher rate than a month ago. A feeling of optimism prevails as to the continuance of metal prices at levels little lower, at worst, than those ruling today, and effort is now centered on steady and economical output during the winter. Generally speaking, conditions for underground work improve as the thermometer drops outdoors; ventilation is better and miners feel better. A more productive day's work is the result. Some companies doubtless will increase their output materially, but it seems probably that the current rates of production indicate closely the approximate scale of operations for the next few months.

In California, lode-gold mining is more active than for a long time. The Belmont Shawmut is now producing about 450 tons per day of $5 gold ore. The California Rand Silver Co.'s flotation plant at Randsburg is handling 200 tons of 25-oz. silver ore daily and high-grade ore is being shipped. In Plumas County, the Engels and Walker copper mines keep an even tenor, with about 1,250,000 lb. each per month.

Tonopah (Nev.) production is at the maximum, the rate being about $600,000 per month, with the Tonopah Extension and Belmont companies leading, with $150,000 each, followed by the West End, $120,000; Tonopah Mining, $100,000; and several small producers. The Tonopah Divide in November shipped 1,800 tons of $25 ore to Tonopah; the Rochester Silver Corporation produced $50,000 in bullion, and the White Caps, $30,000. The Candelaria Mines Co. is treating 250 tons of $15 ore per day in its new cyanide plant; the United Comstock has brought the capacity of its 2,000-ton plant up to 1,500 tons of ore averaging about $5; and the new Betty O'Neal mill is handling 100 tons of $20 ore daily. The Yellow Pine, at Goodsprings, has resumed zinc mining after two years of idleness, and the Nevada Consolidated has brought its tonnage of copper ore up to 2,400 per day in two new units.

The following table shows the approximate current rate of production of the copper mines of Arizona in pounds per month:

Old Dominion	2,250,000	Copper Queen (P. D.)	7,700,000
Miami	6,000,000	United Verde Extension	3,500,000
Inspiration	7,500,000	Ray Consolidated	3,000,000
United Verde	5,500,000		
Calumet & Arizona	3,700,000		

Along the border in Mexico, Greene-Cananea is producing 2,500,000 lb. of copper per month; the new Moctezuma mill is shipping concentrate to Douglas, from which 3,500,000 lb. is recovered. The Ahumada and Erupción mines are shipping to El Paso enough ore to return 30,000,000 lb. of lead and 3,000 oz. of silver monthly.

At Garfield, the Utah Copper Co. has started three "flotationized" sections of the Magna mill, and the plan is to start three more during the next few months. This will give a daily capacity of about 8,000 tons, with six sections still idle. The Arthur plant is handling 17,000 tons per day, making the current combined monthly copper production about 12,000,000 pounds.

The Utah Consolidated is milling 800 tons per day at Tooele. Other shipments from Bingham during November were: United States mines, 9,000 tons; Utah Apex, 5,450 tons; Bingham Mines Co., 1,700 tons—all silver-lead ore; Montana Bingham, 1,300 tons of copper-silver ore; and Ohio Copper, 60 tons of cement copper.

Tintic production for November exceeded that of October by 10 per cent. Shipments in tons were:

Chief Consolidated	11,450	Dragon Consolidated	2,000
Eagle & Blue Bell	3,100	Iron Blossom	1,950
Colorado	2,000	Centennial Eureka	550
Tintic Standard	7,800		

At Park City, the Park Utah company shipped 4,088 tons of 50-oz. silver ore; Silver King Coalition, 4,201 tons of high-grade lead-silver ore and concentrate; Park City Mining & Smelting Co., 4,854 tons; and Ontario, 1,630 tons.

In the Coeur d'Alene district of Idaho the Bunker Hill company is running two lead furnaces, making 200 tons of lead per day. A material increase is reported in the output of lead-silver ore, the total being 22,800 tons of an average value of $50, with an aggregate value of well over a million. The following figures are approximate monthly outputs in tons of lead ore: Bunker Hill & Sullivan, 6,000; Federal, 5,000; Hecla, 4,000; Hercules, 3,000; Tamarack, 2,500; Callahan (started during the month), 700; miscellaneous, 1,600. The Callahan also produced 1,500 tons of zinc ore and the Federal 2,500 tons. At Talache, 175 tons per day of $20 ore is being concentrated. The Idaho Continental, at Port Hill, is making 800 tons per day of 65 per cent silver-bearing lead concentrate.

Production at Butte is still regulated by the number of miners available, although the Anaconda company has 800 more miners than in September, and 9,000 men are reported to be working in the mines of the district. Anaconda is getting 300 tons of zinc ore daily from its Emma mine. The Butte & Superior is concentrating about 1,000 tons of 14 per cent zinc-silver ore, and Senator Clark's Elm Orlu almost as much. All of this zinc finds its way to Great Falls, where Anaconda is operating its electrolytic plant at full capacity. The Davis Daly company is getting about 1,000 tons per day from its Colorado and Hibernia mines. Rates of monthly copper production are approximately as follows: Anaconda, 14,200,000 lb.; North Butte, 1,800,000 lb.; East Butte, 600,000 lb.

In New Mexico, the only important mine not now operating is the Burro Mountain property of the Phelps Dodge Corporation. The Chino Copper Co. is mining ore to produce about 2,500,000 lb. of copper per month; and the Calumet & Arizona company is shipping 350 tons of copper ore daily from its "85" mine to Douglas, Ariz.

In the Joplin-Miami zinc-lead district 122 properties are producing 11,000 tons of concentrate per week, equivalent to about 6,000 tons of slab zinc.

The doubling of its regular dividend rate to 50c. per month by the Homestake company indicates the condition of gold mining in South Dakota. The production for the Black Hills during November was $568,000 in bullion, of which the Trojan contributed $50,000.

Michigan copper production is at about 50 per cent of normal, or 11,000,000 lb. per month. Figures in pounds for November follow:

Calumet & Hecla	5,000,000	Ahmeek	1,722,000
Isle Royal	500,000	Copper Range	1,725,000
Mohawk	800,000	Wolverine	300,000
Quincy	900,000		

Northern Ontario production has been interfered with by shortage of power. In November the Mining Corporation produced 150,000 oz. of silver; Coniagas, 100,000; Nipissing, 275,000; Keeley, 90,000; and McKinley, 55,000. Gold production figures are as follows:

Wright-Hargreaves	$75,000	Lake Shore	$35,000
Kirkland Gold	35,000	Kirkland Lake	30,000
Teck Hughes	120,000	Hollinger	1,050,000
Dome	400,000	McIntyre	270,000

In British Columbia, the Consolidated Mining & Smelting Co., at Trail, is handling about 38,000 tons per month of rich zinc-lead-silver ore and concentrate, of which 30,000 comes from its own Sullivan mine. The Silversmith, Florence, and Standard mines are among the more important independent shippers. The Granby company has increased its copper output at Anyox to 2,800,000 lb. per month.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
30	.....	.....	.....	.....	.....	.....
Dec. 1	13.625	34 875	36 125	7.10	6.95@6.975	7.00@7.05
2	13.65	35.00	36.25	7.10	6.95@6.975	7.05@7.10
4	13.65	34.875	36.00	7.10	6 95@6.975	7.10@7.15
5	13.65	35.125	36.25	7.10	6.95@6.975	7.10@7.20
6	13.65	35.875	37.00	7.10	6.95@6.975	7.15@7.20

*These prices correspond to the following quotations for copper delivered: Dec. 1st, 13.875c.; 2d to 6th inc., 13.90c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Federal bureaus in Washington which are interested in the mining industries.

London

Nov.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
30	62	62⅞	69½	174	175⅛	26	25¼	39	35¾
Dec. 1	62¼	63⅛	69¾	175	176	25⅞	25	37¾	35⅛
4	62¼	63⅛	69⅜	174¼	175⅜	25⅞	25	38	35½
5	62¼	63⅛	69⅜	176	177	25⅞	25	38⅜	35¾
6	62⅜	63⅛	69½	179¼	180½	25⅞	25⅛	38¾	35¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Dec.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
30	.....	.....	.....	32⅛	4	4.52¼	99¼	64⅝	32 3/16
Dec. 1	4.51⅛	99¼	64⅜	32⅜	5	4.53¼	99⅛	65⅛	32 7/16
2	4.52¼	99¼	64⅛	32 3/16	6	4.56	99⅜	65⅜	32⅜

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, Dec. 6, 1922

Copper has sold in fair volume during the week, but most of the other metals have been more than usually quiet. Practically all metal consumers are looking forward to a particularly successful year in 1923, though the slowness of European recovery is disappointing.

Copper

Most of the talk in the copper market during the week has had to do with the rumored acquisition by the Anaconda company of the Guggenheims' interest in Chile Copper, which, it is thought, would lift the Chile production out of competition with that of higher-cost producers. No official announcement has been made, but it is likely that the deal will go through as soon as satisfactory financial arrangements can be made. The rumors have had a slight strengthening effect on the copper market, and some producers are now asking 14c. delivered, especially for metal for delivery far forward. Most of the business has been for December-January-February, and the price has been generally 13⅞c. delivered, though premiums have been obtained above this price for certain lots or where the freight rate is unfavorable. Several producers continue to quote 13⅞c. delivered today on desirable business, but the undertone is firm. Export business continues fair, with France and Italy the principal buyers.

Lead

The official contract price of the American Smelting & Refining Co. continues at 7.10c., New York.

Sales of lead have not been so large as last week. Some producers report an almost entire absence of inquiry. Certainly the situation is much easier than it was a few weeks ago, and it is reported that consumers are having no difficulty in getting lead at the price set by the leading interest, for December-January shipment. Spot lead is reported to command premiums of 10 to 15 points, but almost none has been sold. Consumers report business as good as ever and prospects unusually encouraging for the first half of the new year. The easier feeling in the lead market is attributable to increased supplies, chiefly from Mexico and Canada, rather than to decreased consumption. The St. Louis market is exceedingly quiet and the quotations are almost nominal.

Zinc

The market has shown some improvement in price owing almost wholly to the support given it by European business, it being more profitable for many producers to ship abroad than to sell in the domestic market. The export demand has been far better than that from domestic consumers; otherwise the market would hardly have shown the advancing tendency that it has, as galvanizers have not been anxious buyers. It is reported that their orders have slumped off somewhat. Zinc for prompt shipment is scarce and commands a premium over forward metal. High-grade zinc continues to be sold in satisfactory volume for 8.25c. per lb., with 30c. per 100 lb. freight allowance. The New York price on Prime Western continues at 35c. per 100 lb. above the St. Louis basis.

Tin

Tin continues dull, with practically all business between traders and speculators. The price for prompt delivery is well below import cost. Production in this country promises to be small, with the more favorable smelting costs now obtaining in England. Statistics of the New York Metal Exchange show the total visible supply of tin, Nov. 30, as 25,286 long tons, compared with 22,902 a month previous. United States arrivals during November, 4,652; deliveries, 4,812. Arrivals in December: 1st, Straits, 935; China, 10; 2d, Java, 25; Straits, 35; 4th, Straits, 75.

Tin for forward delivery ruled from the same prices as were asked for spot to one-quarter cent above.

Silver

The recent fall in silver has been checked by an increase in the demand from the Far East, and some speculative bear covering. In addition, the sharp advance in sterling has given the New York market a firm tone, but London continues dull, with limited trading. On Dec. 5, the New York quotation for bar silver of "Domestic Origin" was increased from 99¼c. to 99⅝c. per ounce, 999 fine. This increase is due to the decreased cost of transportation, as the U. S. Government is again accepting delivery at the Philadelphia Mint instead of at the Denver Mint.

Mexican Dollars—Dec. 1st, 49⅜; 2d, 49¼; 4th, 49⅜; 5th, 49⅜; 6th, 49⅜.

Gold

Gold in London: Nov. 30th, 91s. 3d.; Dec. 1st, 91s. 4d.; 4th, 91s. 1d.; 5th, 90s. 10d.; 6th, 90s. 7d.

Foreign Exchange

On Tuesday, Dec. 5, cable quotations for francs were 6.965c.; lire, 4.89c.; marks, 0.01⅛c.; and Canadian dollars, par.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—General market for 99 per cent grade, 22@23c. per lb. London quotations, £92 10s.

Antimony — Chinese and Japanese brands, 6.45c. W. C. C., 6.75@7.25c. Cookson's "C" grade, spot, 8⅜@9c. Chinese needle antimony, lump, nominal, 4.50c. per lb. Standard powdered needle antimony (200 mesh), 5½c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 6.75@7c. Market more active.

Bismuth—$2.45 per lb. London quotes 10s.

Cadmium—$1.15 per lb. London quotes 5s. 6d.

Iridium—$240@$275 per oz.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market quiet at 32@34c. per lb.

Palladium—$60 per oz. London, £17.

Platinum—$108 per oz. London, £23.

Quicksilver—$71@$72 per 75-lb. flask. San Francisco wires $70.70. London, £12.

The prices of **Cobalt, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium** and **Thallium** are unchanged from prices given Dec. 2.

Metallic Ores

Chrome Ore—Indian chrome ore, $18.50 per ton, c.i.f. Atlantic ports. Rhodesian and New Caledonian, $23 and $25 per ton. Market quiet.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5 per long ton; old bed concentrates, 63 per cent, $5 25; Harmony, cobbed, 63 per cent, $5.25; new bed low phosphorus, 65 per cent, $7.50.

Manganese Ore—30c. per long ton unit, seaport, plus duty; equivalent to about 45c. Chemical ore, $75@$80 per gross ton.

Molybdenum Ore—60c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates, plus duty; equivalent to 85@90c. per lb.

Tungsten Ore — Wolframite, $7.50; scheelite, $8.50@$8.75 per unit of WO_3, f.o.b. New York.

Iron ore, Tantalum, Titanium, Uranium, Vanadium, and **Zircon** ore are unchanged from the quotations published Dec. 2.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 2—Zinc blende, per ton, high, $46.30; basis 60 per cent zinc, premium, $44@$45; Prime Western, $42@$43; fines and slimes, $41@$39; average settling price, all grades of blende, $41.75. Calamine, basis 40 per cent zinc, $22@$23; average, $22.82.

Lead, high, $94.30; basis 80 per cent lead, $93; average settling price, all grades of lead, $87.63 per ton.

Shipments for the week: Blende, 17,816; calamine, 100; lead, 2,527 tons. Values all ores the week, $963,490.

Buyers claim there are 60,000 tons of zinc ore in the bins at the mines, contracted for sale. For the first time in many months shippers have found shipping facilities nearly adequate to the demand. Even with the better service the past three weeks the supply of cars is still 200 short each week.

Platteville, Wis., Dec. 2—Blende, basis 60 per cent zinc, $45 per ton. Lead, basis 80 per cent lead, $93 per ton. Shipments for the week: Blende, 4,031 tons; lead, none. Shipments for the year: Blende, 26,200; lead, 1,349 tons. Shipped during the week to separating plants, 809 tons blende.

Non-Metallic Minerals

China Clay (Kaolin)—Crude, $6@$8; washed, $8@$9; powdered, $12@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $14@$20, f.o.b. Virginia points. Imported lump, $15@$22, f.o.b. American ports; powdered, $40@$45, f.o.b., New York. 1A grade, refined, $14@$15 per ton, Delaware. Canadian, in lumps, $16@$18, f.o.b. Quebec points.

Fluorspar — Fluxing gravel, 85 per cent CaF_2 and not over 5 per cent silica, $21.50, f.o.b. mines; not over 6 per cent silica, $21; 80 per cent grade, not over 5 per cent silica, $20; ground acid grade, $45 in bulk; ground enameling grade, $35 in bulk; packages, $4 extra, all f.o.b. mines, Illinois. No. 1 lump, $30; No. 2, lump, $25, f.o.b. Illinois mines.

Magnesite—$15 per ton for crude, $40 for unground calcined magnesite, f.o.b. California points. Northwest American magnesite industry shut down. Dead-burned magnesite grains, $43.50 per net ton, f.o.b. Baltimore; $45, Chester, Pa. Demand increasing for white plastic magnesite.

Mica—Scrap material, $22 per short ton, New Hampshire points; disk, 15c. per lb.; washer, 8@10c. For other mica quotations see issue of Dec. 2.

Talc—Ground from 150 to 200 mesh, $6.50@$8.50 per ton, bags extra ($1 for 50-lb. paper bags or 10c. each for burlap bags, 12 to the ton), f.o.b. Vermont. Competition keen. Demand has dropped about 20 per cent lately. For other talc prices see issue of Dec. 2.

Asbestos, Barytes, Bauxite, Chalk, Diatomaceous Earth, Emery, Feldspar, Fuller's Earth, Graphite, Gypsum, Limestone, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur and **Tripoli** are unchanged from the prices published Dec. 2.

Mineral Products

Arsenious Oxide (white arsenic)—Actual sales averaged about 12.75c. per lb. Buyers willing to pay up to 15c. if they could secure prompt supplies.

Copper Sulphate, Potassium Sulphate, and **Sodium Sulphate** are unchanged from quotations of Dec. 2.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $100 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $39, f.o.b. furnace; 16@19 per cent, $38.

Ferrosilicon—10 to 15 per cent, $38@$40 per gross ton, f.o.b. works; 50 per cent, $75@$80; 75 per cent, $115@$120.

Ferrotungsten—Domestic, 70@80 per cent W, 85@95c. per lb. of contained W, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferro-uranium, and **Ferrovanadium** are unchanged from the prices published Dec. 2.

Metal Products

Copper Sheets, Lead Sheets, Nickel Silver, Zinc Sheets and **Yellow Metal** are unchanged from the prices published Dec. 2.

Refractories

Bauxite Brick, Chrome Brick, Chrome Cement, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the prices published Dec. 2.

The Iron Trade

Pittsburgh, Dec. 5, 1922

Finished-steel prices are firm in some lines, and barely steady in others, but there are no definite declines. Concessions from the regular price of 2c. on bars, shapes, and plates are not new.

Mills are sold up for various distances ahead, the Steel Corporation on the whole having by far the largest order book.

Pig Iron—Inquiry remains light, but predictions are made that a buying movement in foundry iron may occur even this month. Quotations are down 50c. on bessemer, to $28; $1 on basic, to $25.50, and 50c. on foundry, to $26.50, at Valley furnaces, with $1.77 freight to Pittsburgh.

Connellsville Coke—Prompt furnace coke is off 25c., at $7 to $7.25, foundry being unchanged at $7.50 to $8. Furnace coke for first quarter has been quoted at $8, which does not interest consumers.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1921	1922	1921	1922	1921	1922
January	65.950	65.450	39.985	35.035	372.650	421.750
February	59.233	65.290	34.745	33.891	385.932	435.511
March	56.023	64.440	32.479	33.269	389.806	436.912
April	59.337	66.575	34.250	34.080	391.784	440.715
May	59.810	71.154	34.165	36.023	396.580	444.106
June	58.510	71.149	34.971	35.900	377.236	444.615
July	60.260	70.245	37.481	35.644	362.565	444.165
August	61.597	69.417	38.096	34.957	364.505	446.069
September	66.160	69.515	40.082	35.305	371.725	442.800
October	70.970	68.015	41.442	34.498	386.315	443.583
November	68.234	65.177	38.750	32.882	396.315	447.484
December	65.760	.....	35.645	.....	414.880	.....
Year	62.654	.....	36.841	.....	384.191	.....

New York quotations cents per ounce troy, 999 fine, foreign silver. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1921	1922	1921	1922	1921	1922
January	12.597	13.465	70.964	65.226	79.119	72.321
February	12.556	12.864	70.925	60.250	75.925	66.125
March	11.976	12.567	67.565	59.245	71.190	65.739
April	12.438	12.573	69.381	58.799	71.786	64.028
May	12.742	13.111	73.196	61.092	74.298	66.554
June	12.697	13.575	71.852	61.988	75.682	69.333
July	12.170	13.654	71.155	63.137	75.286	70.321
August	11.634	13.723	68.614	63.784	72.705	69.932
September	11.948	13.748	67.977	63.113	72.295	70.917
October	12.673	13.632	67.327	62.773	73.476	70.693
November	13.035	13.598	66.614	62.795	74.386	70.216
December	13.555	.....	66.706	.....	74.525	.....
Year	12.502	.....	69.356	.....	74.223	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1921	1922	1921	1922	1921	1922
January	4.821	4.700	4.747	4.388	23.387	23.667
February	4.373	4.700	4.228	4.396	20.650	20.681
March	4.084	4.720	4.000	4.421	18.911	21.266
April	4.356	5.115	4.272	4.946	20.589	22.993
May	4.952	5.420	4.784	5.281	23.399	24.462
June	4.485	5.745	4.293	5.563	22.563	24.685
July	4.410	5.729	4.260	5.447	23.399	24.869
August	4.382	5.824	4.217	5.537	23.489	24.580
September	4.600	6.110	4.392	5.868	23.148	24.131
October	4.690	6.530	4.439	6.338	23.679	25.551
November	4.683	7.047	4.356	6.868	24.483	26.199
December	4.700	.....	4.369	.....	25.322	.....
Year	4.545	.....	4.363	.....	22.752	.....

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York				London	
	99%		Straits			
	1921	1922	1921	1922	1921	1922
January	31.470	31.480	36.000	32.100	190.464	163.065
February	28.534	29.835	32.142	30.767	166.250	149.850
March	27.296	28.426	28.806	29.171	156.024	143.152
April	28.990	29.810	30.404	30.605	163.905	149.840
May	31.431	30.149	32.500	30.971	177.411	150.163
June	28.514	30.707	29.423	31.497	167.506	152.512
July	26.755	31.025	27.655	31.733	164.530	156.149
August	25.662	32.134	26.301	32.380	155.318	160.006
September	26.280	32.075	26.680	32.395	156.750	160.065
October	27.278	33.935	27.655	34.600	156.380	170.563
November	28.592	35.911	28.935	36.734	158.898	179.341
December	32.106	.....	32.486	.....	169.738	.....
Year	28.576	...	29.916	.....	165.265	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1921	1922	1921	1922
January	5.413	4.691	25.262	26.321
February	4.928	4.485	24.850	24.213
March	4.737	4.658	25.077	25.467
April	4.747	4.906	25.530	26.576
May	4.848	5.110	26.923	27.304
June	4.421	5.346	26.750	27.893
July	4.239	5.694	26.262	29.042
August	4.186	6.212	25.068	31.170
September	4.235	6.548	25.256	31.750
October	4.605	6.840	26.315	34.528
November	4.667	7.104	25.949	38.011
December	4.835	...	26.900	.....
Year	4.655	.....	25.845	.....

St. Louis quotations, cents per pound. London, pounds sterling, per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)	
	New York		New York		New York	
	1921	1922	1921	1922	1921	1922
January	5.258	4.463	48.440	49.960	73.400	97.260
February	5.250	4.416	49.545	48.295	70.227	89.545
March	5.282	4.319	46.796	50.204	72.463	87.500
April	5.137	4.980	45.423	52.280	73.404	87.500
May	5.250	5.467	47.000	54.885	73.740	85.529
June	5.087	5.145	46.846	55.115	74.942	87.212
July	4.735	5.091	44.950	55.000	70.440	90.180
August	4.597	5.315	45.028	57.593	73.222	98.370
September	4.564	6.580	42.660	67.640	75.960	117.280
October	5.085	6.905	39.840	72.560	81.800	109.440
November	4.734	6.584	39.804	71.521	82.609	108.000
December	4.500	.....	49.212	.....	78.192	.....
Year	4.957	.....	45.462	.....	75.033	.....

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1921	1922	1921	1922	1921	1922
January	33.96	21.55	31.96	20.15	33.88	21.34
February	28.96	21.46	26.96	19.71	30.25	20.88
March	28.16	21.35	26.46	19.96	27.85	20.83
April	26.96	22.50	24.46	21.26	26.77	22.70
May	26.21	26.36	23.84	26.87	25.56	25.96
June	24.96	26.96	22.66	26.96	24.38	25.96
July	22.84	26.77	20.76	26.33	22.36	25.97
August	21.96	30.44	20.29	27.18	21.53	30.81
September	21.96	35.27	21.21	34.70	22.82	36.75
October	21.96	35.27	20.96	31.77	22.96	33.40
November	21.96	33.52	20.96	29.37	22.74	30.55
December	21.96	.....	20.65	.....	21.96	.....
Year	25.15	.....	23.43	.....	5.26	.....

In dollars per long ton.

Monthly Crude Copper Production

	1922			
	July	August	September	October
Alaska shipments	4,510,953	3,366,952	5,250,340	6,771,700
Washoe Smelter	13,600,000	14,000,000	13,800,000	15,980,000
Calumet & Arizona	3,310,000	4,038,000	3,398,000	3,916,000
Calumet & Hecla	(c)	(c)	(c)	(c)
Other Lake Superior	(c)	(c)	(c)	(c)
Chino	2,758,610	3,443,240	3,390,086	(c)
East Butte	(c)	(c)	(c)	(c)
Inspiration	(a)	(a)	(c)	(c)
Miami	5,915,000	6,383,000	5,666,715	6,172,000
Nevada Cons.	2,065,053	1,509,353	1,203,894	(c)
New Cornelia	1,783,950	2,854,183	3,065,400	3,226,618
Old Dominion	2,787,000	2,718,000	2,636,000	2,772,000
Phelps Dodge	6,645,000	7,615,000	7,609,000	6,984,000
Ray	2,908,551	3,844,461	3,532,817	(c)
Shattuck Arizona	( )	(a)	(a)	(a)
Southwest Metals Co.	570,000	575,000	716,000	(c)
United Verde	5,600,000	6,000,000	5,310,000	(c)
United Verde Extension	2,646,810	3,250,934	3,556,010	3,760,234
Utah Copper	11,175,419	10,148,606	10,605,132	(c)
Others, estimated	9,600,000	10,500,000	10,300,000	11,500,000
Total United States	.....	.....	.....	.....
Imports: Ore and concentrates, matte	10,934,340	11,801,156	12,815,916	.....
Imports of black and blister, unrefined	25,656,776	28,504,557	37,052,679	.....
Imports of refined and old	7,230,319	16,851,411	7,299,193	.....
Grand total	.....	.....	.....	.....
Backus & Johnston	( )	(c)	(c)	(c)
Boleo	1,171,958	1,364,025	1,160,933	1,214,925
Cananea	1,105,958	(c)	(c)	(c)
Cerro de Pasco	( )	(c)	(c)	(c)
Chile	(c)	(c)	(c)	(c)
Cons. M. & S. of Canada	(a)	(a)	(a)	(a)
Falcon Mines	549,120	594,000	584,000	584,000
Furukawa	2,834,980	2,771,880	.....	.....
Granby Cons.	2,601,007	2,924,760	2,179,890	2,638,414
Hampden Cloncurry	(a)	(c)	(c)	(c)
Katanga	8,972,145	8,553,195	7,766,010	8,352,540
Mount Morgan	920,000	882,000	956,000	.....
Mount Lyell	900,000	656,000	2,252,600	(c)
Phelps Dodge Mexican	1,505,000	1,587,000	2,500,000	2,732,000
Sumitomo	2,298,856	4,092,410	2,933,812	2,596,060
Wallaroo & Moonta	(a)	(a)	(a)	(a)

Comparative Annual Copper Production

	1919	1920	1921	1922
January	135,733,511	121,903,744	90,596,597	32,010,292
February	111,649,512	117,540,000	86,682,941	45,957,530
March	102,040,460	120,309,316	91,046,345	55,705,760
April	98,808,998	116,078,871	46,946,523	(c)
May	92,652,975	114,964,207	25,310,511	(c)
June	95,856,570	116,107,856	24,623,693	(c)
July	100,369,247	109,729,610	22,033,739	(c)
August	107,994,040	112,460,254	23,248,398	(c)
September	108,703,075	104,919,562	23,855,316	(c)
October	115,143,143	105,231,571	23,231,572	(c)
November	117,289,735	106,700,178	28,341,442	.....
December	102,997,633	95,709,009	29,629,137	.....

(a) No copper produced during this month. (c) Not available.

COMPANY REPORTS

Utah Copper Co.

A report of the operations of the Utah Copper Co. for the third quarter of 1922 states that the net production of marketable copper, after allowing for smelter deductions, was 30,767,766 lb., compared with 21,332,691 lb. for the previous quarter. During the period there was treated at the Arthur plant 1,518,200 tons of ore, being 373,721 tons more than for the preceding quarter. The average grade of the ore milled was 1.296 per cent copper, and the average recovery was 81.14 per cent of the total copper contained in the ore, as compared with 1.22 per cent copper and an average recovery of 79.51 per cent for the second quarter.

The average cost per net pound of copper produced, including all fixed and general charges, but excluding federal taxes, was 9.585c. The gold and silver values in the concentrates are equal to 1.003c. per pound.

The following statement shows the financial results of the company's operations for the quarter, as compared with the previous quarter:

	Third Quarter 1922	Second Quarter 1922
Net profit from copper production only	$1,278,505.44	$323,293.81
Miscellaneous income, including payment for precious metals	417,156.83	380,864.84
Total income for the quarter	$1,695,662.27	$704,158.65

Earnings for the third quarter are computed on the basis of 13.74c. per pound for copper. The quarterly disbursement to stockholders on Sept. 30, 1922, was 50c. per share, amounting to $812,245.

There was removed during the quarter a total of 461,218 cu.yd. of stripping, being an average of 153,739 cu.yd. per month, as compared with 223,639 cu.yd. and 74,546 cu.yd., respectively, for the second quarter of the year. The ore delivery department transported a total of 1,610,873 tons of ore, being an average of 17,509 tons per diem. The Bingham & Garfield Ry. Co., operating in its own common-carrier capacity, transported a total of 200,792 tons of freight, or an average of 2,183 tons per diem.

To meet the competitive wage situation, the company, in common with others operating in the state, increased wages, on Sept. 1, 50c. per day to skilled labor and 40c. to semi-skilled.

Chino Copper Co.

Copper; New Mexico

A report of the operations of the Chino Copper Co. for the third quarter of the calendar and fiscal year ended Sept. 30, 1922, states that the seventh shovel was manned for service at the mines on July 24, and a fourth section of the concentrator was placed in operation on Aug. 16. At the end of the quarter, four mill sections, together with the necessary portion of the regrinding section, were in operation.

The net copper produced, after smelter deductions, amounted to 9,208,275 lb., compared with 6,652,174 lb. for the preceding quarter.

The total amount of dry ore treated by the mill for the ninety-two days operated during the quarter was 498,926 tons, or an average of 5,423 tons per operating day, the average grade being 1.49 per cent copper, as compared to 1.55 per cent copper for the second quarter.

There was produced a total of 24,225 dry tons of concentrates, averaging 19.80 per cent copper, equivalent to a recovery of 19.23 lb. of copper per dry ton of ore treated, as compared with 13,568 dry tons of an average grade of 25.42 per cent copper and a recovery of 21.22 lb. per dry ton of ore treated during the second quarter.

There was an actual decrease of 15.5c. in the cost per ton of ore treated, but owing to the fact that more highly oxidized and lower-grade ore was milled than in the previous quarter, the resulting cost per pound of net copper was somewhat higher, due to the lower recovery. The cost per pound of net copper produced from mill operations was 14.36c. as compared with 13.71c. for the quarter ended June 30. This cost includes all items of fixed and general overhead expenses, except charges for Federal taxes. Credit for the precious metals amounted to 0.04c. per pound of copper, so that the net cost was 14.32c. per pound.

Following are the financial results of the company's operations for the periods under consideration:

	1922	
	Third Quarter	Second Quarter
Operating loss	$48,427.12	$43,222.01
Shutdown and other non-operating expenses	45,206.10	129,389.12
	$93,633.22	$172,611.13
Miscellaneous income, including precious metals	46,310.67	46,480.16
Loss for quarter	$47,322.55	$126,130.97

The above figures are based on an average of 13.83c. per pound for copper, as compared with 13.06c. per pound for the quarter ended June 30.

Ray Consolidated Copper Co.

Copper; Arizona

A report covering the operations of the Ray Consolidated Copper Co. for the third quarter of 1922 states that the total net production of copper, after allowing smelter deduction, was 10,079,470 lb., compared with 5,624,243 lb. for the previous quarter.

There were milled, in the period covered by the report, 436,000 dry tons, averaging 1.57 per cent of copper, an average daily tonnage of 4,739 tons, compared with an average of 2,996 tons per day for the actual operating days of the previous quarter. The mill recovery was 75.23 per cent of the total copper contained in concentrating ores, compared with 73.43 per cent for the previous quarter.

The milling cost for the quarter, including the customary proportion of fixed and general expenses, was 97.22c. per ton, compared with $1.38 per ton for the previous quarter. The average mining cost of ore milled was $1.14 per ton, including the usual charge of 15c. per ton for the retirement of pre-paid mine-development expense. Of this total 2.313c. was the cost of coarse crushing and loading, leaving a net mining cost of $1.12 per ton, compared with $1.52 for the previous quarter. The average cost per pound of net copper produced was 13.51c., compared with a cost of 18.03c. for the previous quarter. This figure includes all general expenses other than federal income taxes, and also takes into account credit for the value of gold and silver.

Miscellaneous income amounted to 0.326c. per pound, resulting in a net cost of 13.18c. per pound, compared with 16.92c. for the previous quarter.

The financial results for the quarter, compared with those of the previous quarter, are as follows:

	Third Quarter 1922	Second Quarter 1922
Operating profit or loss	$22,095.45	(a)$312,069.22
Miscellaneous income and gold and silver	35,704.69	64,201.99
Net surplus or loss for quarter	$57,800.14	(a)$247,867.23

(a) Indicates loss.

The average carrying price of copper for the quarter was 13.760c., compared with a carrying price of 13.026c. for the previous quarter.

El Oro Mining & Ry. Co., Ltd.

Gold; Mexico

A report of operations of the El Oro Mining & Ry. Co., Ltd., for the year ended June 30, 1922, shows a net profit of £83,602 15s. 2d.[1] as the following profit-and-loss account shows:

DEBIT

	£	s.	d.
Mining expenditure	470,192	15	4
Railway department expenditure	22,716	9	2
London expenses	2,556	10	10
Directors' fees	2,500	0	0
Depreciation of plant and machinery	25,000	0	0
Provision for income tax and corporation profits tax	30,000	0	0
Exchange	9,270	19	7
Balance carried to balance sheet	83,602	15	2
	645,839	10	1

CREDIT

	£	s.	d.
Bullion recovered	538,250	10	9
Railway department receipts	70,641	11	6
Interest and dividends	36,047	13	6
Sundry receipts	899	14	4
	645,839	10	1

Balance sheet as of June 30, 1922, is given as follows:

DEBIT

	£	s.	d.	£	s.	d.
Capital authorized	1,150,000	0	0			
Capital issued				1,147,500	0	0
Sundry credit balances				131,673	0	5
Sundry shareholders for dividends				1,880	19	0
Profit-and-loss account						
	£	s.	d.			
Balance of account, June 30, 1921	131,906	10	9			
Add dividend No. 30, not distributed	57,375	0	0			
	189,281	10	9			
Less dividend —No. 31	57,375	0	0			
	131,906	10	9			
Add profit for year to June 30, 1922	83,602	15	2			
	215,509	5	11			
Less written off cost of shares in Cia. de Inversiones, per contra	119,060	1	9			
				96,449	4	2
				1,377,503	3	7

Production amounted to 401,840 tons milled, assaying $5.14 in gold and $1.24 in silver. Bullion value realized totaled $2,203,015.22.

[1] Exchange taken as $4.42 = £1.

International Nickel Co.

A comparative consolidated general balance sheet of the International Nickel Co. for the six months ended Sept. 30, 1922, follows:

ASSETS

	March 31, 1922	Sept. 30, 1922
Property	$49,761,054.84	$50,661,026.60
Investments	558,485.13	560,409.13
Inventories	9,340,598.86	7,345,460.49
Accounts and bills receivable	776,149.44	802,439.14
Advances	144,889.75	278,372.41
Government securities	100,000.00	100,000.00
Loans on call	1,013,000.00	1,011,000.00
Cash	756,773.71	1,260,505.10
	$62,450,951.73	$62,019,212.87

LIABILITIES

Preferred stock	$8,912,600.00	$8,912,600.00
Common stock	41,834,600.00	41,834,600.00
Accounts payable and tax reserves	688,809.79	596,863.59
Preferred dividend payable	133,689.00	133,689.00
Accident insurance and contingent reserves	865,412.55	899,826.00
Surplus	10,015,840.39	9,641,634.28
	$62,450,951.73	$62,019,212.87

A consolidated general profit-and-loss statement for the six months ended Sept. 30, 1922, follows:

Earnings		$417,378.72
Other income		47,714.09
Total income		$465,092.81
Administration and general expense	$169,656.33	
Reserved for federal and franchise taxes	21,171.11	190,827.44
Net income		$274,265.37
Preferred dividend No. 67, paid Aug. 1, 1922	$133,689.00	
Preferred dividend No. 68, payable Nov. 1, 1922	133,689.00	267,378.00
Balance		$6,887.37
Shutdown expense and depreciation		381,093.48
Reduction in surplus		$374,206.11

Mount Lyell Mining & Ry. Co., Ltd.

An operating statement recently issued by the Mount Lyell Mining & Ry. Co., Ltd., indicates that ore smelted during the year ended Sept. 30 last was: Mount Lyell mine, 36,820 tons; North Mount Lyell mine, 20,196 tons; total, 57,016 tons; also concentrates, 23,495 tons. The development of the treatment of concentrates by sintering and smelting enabled the management to dispense with use of pyrites almost entirely since the month of March last. A total of 3,297 tons pyrites was shipped for acid making. The resumption of such shipments was made possible by federal duties on imported sulphur. The company produced 6,066 tons of blister copper, containing copper, 6,019 tons; silver, 137,392 oz.; gold, 2,761 oz. Reduction in gold and silver contents follows the decline in tonnage of Mount Lyell pyrites smelted.

Operations for the year resulted in a net profit of £127,490. There was written off, mine prospecting, £3,430; depreciation, £33,715, and taxation, £12,500. Credit balance to profit-and-loss account is £396,944. Liquid assets in excess of liabilities were £654,671. Dividend of 1s. per share has been declared payable on Dec. 18 next, subject to final audit. Ore reserves based on previous figures are: Mount Lyell mine, including South Mount Lyell mine, 1,671,367 tons; North Mount Lyell mine, 993,775 tons. The concentration plant treated 89,443 tons of North Mount Lyell ore; of this, 6,377 tons of sorted ore was sent to smelters; the remainder produced 23,730 tons of concentrates, assaying 17.950 per cent of copper. Direct smelting of North Mount Lyell ore, except occasional lots of high-grade ore, was discontinued last March, and blast-furnace operations were confined to reduction of concentrates from the North Mount Lyell ore.

Additions now being made to the concentration plant and sintering plant are expected to improve the position and enable the output of copper to be maintained on a considerably lower grade of ore than that mined last year, which was 6.870 per cent copper. It is expected that the additions to the reduction works plant will be completed by the end of February. Reduction of wages by the Commonwealth Court of Conciliation and Arbitration has given the company some relief from the burden of the high cost, but the general position is still unsatisfactory. The Commonwealth Court of Conciliation and Arbitration prescribed forty-eight hours weekly for engineers, who refused to accept the award, but are now working under the award.

The company's work is still burdened by the abnormal cost of coal, coke, and local transport. The average price of copper in the period covered was £70 11s. 4d., compared with £80 6s. 11d. for the preceding year, but the improvements in the treatment methods have set off the fall in price. Unless the price improves, operations cannot be expected to yield satisfactory profits on average-grade ore, even when plant alterations are completed, unless there are further reductions in cost of labor and supplies.

At the chemical works the output was as usual. Prospects are favorable for the coming season. Renewal of the first acid unit at the chemical works at Yarraville is completed and a second unit of the plant is soon to be renewed. Alteration in smelting methods releases abundant supplies of pyrites for acid making.

Transvaal Gold Production

The following table summarizes Transvaal gold production since 1917, according to the report of the Transvaal Chamber of Mines:

RAND GOLD OUTPUT 1917-1922, IN FINE OUNCES

	1922	1921	1920	1919	1918	1917
January	639,728	651,593	670,503	676,059	714,183	782,631
February		558,137	625,330	636,728	659,759	721,324
March		671,123	707,036	712,379	696,281	787,091
April	511,338	681,382	686,979	694,944	717,099	742,774
May	629,786	687,776	699,041	724,995	741,217	729,388
June	675,697	678,490	715,957	702,379	727,696	759,725
July	730,635	689,555	736,099	725,497	736,199	757,894
August	752,490	711,526	702,083	706,669	740,210	756,650
September	747,089	691,026	682,173	698,558	708,206	732,230
October	778,159	707,000	662,472	723,722	679,764	751,298
November	.....	704,236	633,737	677,970	658,701	722,839
December	.....	681,847	632,215	650,191	641,245	722,418

MINING STOCKS

Week Ended Dec. 2, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	59	56½	59	Aug. '22, Q	$1.00
Alaska-Br. Col.	N. Y. Curb	2⅛	1⅞	2⅛		
Allouez	Boston	20	20	20	Mar. '19	1.00
Anaconda	New York	49½	45	49	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅛	2⅛	2⅛		
Ariz. Com'l	Boston	7¼	7	7¼	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	8	6	6		
Bingham Mines	Boston	17⅜	17⅜	17⅜	Sept. '19, Q	0.25
Calumet & Arizona	Boston	55¼	50¾	54	Sept. '22, Q	0.50
Calumet & Hecla	Boston	290	270	290	Aug. '22, Q	5.00
Canada Copper	N. Y. Curb	*2	*1	*2		
Centennial	Boston	†9	†8	8	Dec. '18, SA	1.00
Cerro de Pasco	New York	42½	37	41½	Mar. '21, Q	0.50
Chile Copper	New York	28⅛	25⅜	27⅝		
Chino	New York	25	22½	24⅝	Sept. '20, Q	0.37
Copper Range	Boston	38	36	37⅜	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1 9/16	1⅜	1½		
Davis-Daly	Boston	3⅛	2⅞	3	Mar. '20, Q	0.25
East Butte	Boston	8¼	7⅞	8⅛	Dec. '19, A	0.50
First National	Boston Curb	*46	*45	*45	Feb. '19, SA	0.15
Franklin	Boston	1⅜	1 1/16	1 1/16		
Gadsden Copper	Boston Curb	†*75	†*65	*70		
Granby Consol	New York	25	22	25	May '19, Q	1.25
Greene-Cananea	New York	24½	23¼	24½	Nov. '20, Q	0.50
Hancock	Boston	†2½	†2	2		
Howe Sound	N. Y. Curb	2⅜	2⅛	2⅛	Jan. '21, Q	0.05
Inspiration Consol	New York	35⅞	31	35½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	5¾	4	4	Sept. '20, K	0.25
Isle Royale	Boston	21	18½	21	Aug. '22,	0.50
Kennecott	New York	35	30⅞	34½	Dec. '20, Q	0.50
Keweenaw	Boston	1⅞	1⅞	1⅞		
Lake Copper	Boston	3¾	3	3		
Magma Copper	N. Y. Curb	....	....	34	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Mass Consolidated	Boston	2⅛	2¼	2⅛	Nov. '17, Q	1.00
Miami Copper	New York	27⅜	25⅝	27½	Nov. '22, Q	0.50
Michigan	Boston	2⅜	1	1⅜		
Mohawk	Boston	58	54½	58	Nov. '22, Q	1.00
Mother Lode Coa	N. Y. Curb	....	....	11	June '22, I	0.50
Nevada Consol	New York	15	13⅜	15	Sept. '20, Q	0.25
New Cornelia	Boston	16⅛	15⅛	15⅜	Nov. '22, Q	0.25
North Butte	Boston	9⅜	8⅜	9⅜	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*49	*31	*47		
Old Dominion	Boston	17	16	17	Dec. '18, Q	1.00
Osceola	Boston	29⅛	25	29⅛	Aug. '22, Q	1.00
Phelps Dodge	Open Mar.	†170	†160	....	Oct. '22, Q	1.00
Quincy	Boston	33	30½	33	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅜	12⅝	13⅜	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅜	1	1⅜		
St Mary's Min. Ld	Boston	39	37	39	Apr. '22, K	2.00
Seneca Copper	Boston	8	8	8		
Shannon	Boston	*60	*55	*55	Nov. '17, Q	0.25
Shattuck Arizona	New York	8	7	8	Jan. '20, Q	0.25
South Lake	Boston	†1	†*30	*35		
Superior & Boston	Boston	1⅜	1⅜	1⅜		
Tenn. C. & C. cfs	New York	9	8½	9	May '18, I	1.00
Tuolumne	Boston	*42	*41	*42	May '13,	0.10
United Verde Ex	Boston Curb	26	25	26	Nov. '22, Q	0.25
Utah Consol	Boston	2	1⅜	1⅜	Sept '18,	0.25
Utah Copper	New York	63⅞	59	63⅛	Sept. '22, Q	0.50
Utah Metal & T	Boston	1	1	1	Dec. '17,	0.30
Victoria	Boston	1	¾	¾		
Winona	Boston	†1⅛	†*90	*95		
Wolverine	Boston	8	7¼	8		
NICKEL-COPPER						
Internat. Nickel	New York	15⅛	13⅜	14⅞	Mar. '19,	0.50
Internat. Nickel, pfd.	New York	72¼	70	72¼	Nov. '22, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	....	....	5		
National Lead	New York	115⅜	112⅛	115⅜	Sept. '22, Q	1.50
National Lead, pfd	New York	113⅜	111	113⅜	Nov. '22, Q	1.75
St. Joseph Lead	New York	19¾	18½	19¾	Sept. '22, Q	0.25
ZINC						
Am. Z. L. & S.	New York	15¼	13	15	May '20,	1.00
Am. Z. L. & S. pfd	New York	48	48	48	Nov. '20, Q	1.50
Butte C. & Z.	New York	7⅜	7	7⅜	June '18,	0.50
Butte & Superior	New York	30	26	30¼	Sept. '20,	1.25
Callahan Zn-Ld	New York	7⅛	6¾	7⅛	Dec. '20, Q	0.50
New Jersey Zn	N. Y. Curb	172⅝	163	172⅝	Nov. '22, Q	2.00
Yellow Pine	Los Angeles	....	....	*75	Sept. '20, Q	0.03
SILVER						
Batopilas Mining	New York	....	....	½	Dec. '07, I	0.12½
Beaver Consol	Toronto	*30½	*29	*29	May '20, K	0.03
Coniagas	Toronto	1.90	1.85	1.85	May '21, Q	0.12½
Crown Reserve	Toronto	*29	*26½	*29	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	3¼	3⅛	3¼	Oct. '22, Q	0.12½
La Rose	Toronto	*24	*23	*24	Apr. '22,	0.10
McKinley-Dar.-Sav	Toronto	*20	*19½	*19½	Oct. '20, Q	0.03
Mining Corp. Can	Toronto	1	1	1	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6	5⅜	6	Oct. '22, Q,X	0.30
Ontario Silver	New York	...	...	6	Jan. '19, Q	0.50
Temiskaming	Toronto	...	...	*32	Jan. '20, K	0.04
Trethewey	Toronto	5	4½	4½	Jan. '19,	0.05
Alaska Gold	New York	1¼	1⅛	1⅛		

Stock	Exch.	High	Low	Last		Last Div
GOLD						
Alaska Juneau	New York	1⅛	1	1⅛		
Atlas	Toronto	*18	*13	*13½		
Carson Hill	Boston	6⅞	6	6⅞		
Cresson Consol. G	N. Y. Curb	2⅛	2⅛	2⅛	Oct. '22 Q	0.10
Dome Mines	New York	41	40	41	Oct. '22, Q	0.50
Golden Cycle	Colo. Springs	*88	*88	*88	June '21, Q	0.02
Goldfield Consol	N. Y. Curb	*6	*6	*6	Dec. '19,	0.05
Hollinger Consol	Toronto	11.64	11.45	11.64	Nov. '22,	0.05
Homestake Mining	New York	80	79½	80	Nov. '22, M	0.50
Keora	Toronto	*9	*9	*9		
Kirkland Lake	Toronto	*50	*41	*41		
Lake Shore	Toronto	2.89	2.82	2.86	Nov. '22, Q	0.02
McIntyre- Porcupine	Toronto	17.50	17.25	17.50	Sept. '22, K	0.25
Porcupine Crown	Toronto	*20½	*20	*20	July '17,	0.03
Portland	Colo. Springs	*40	*38	*38	Oct. '20, Q	0.01
Schumacher	Toronto	*42½	*42½	*42½		
Teck Hughes	Toronto	*85	*83½	*85		
Tom Reed	Los Angeles	*80	*79	*79	Dec. '19,	0.02
United Eastern	N. Y. Curb	1⅛	1 1/16	1 1/16	Oct. '22, Q	0.15
Vindicator Consol	Colo. Springs	†*5	†*2	*4	Jan. '20, Q	0.01
Vipond Cons	Toronto	*59	*56	*58		
White Caps Mining	N. Y. Curb	....	....	*10		
Wright-Hargreaves	Toronto	3.35	3.35	3.35	Oct. '22,	0.05
Yukon Gold	N. Y. Curb	*60	*50	*50	June '18,	0.02½
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*6	*5	*5		
Cons. Virginia	San Francisco	*13½	*11½	*12½		
Dolores Esperanza	N. Y. Curb	2½	1⅞	2½	Oct. '22	2.50
El Salvador	N. Y. Curb	*3	*2	*3		
MacNamara M.&M.	N. Y. Curb	*8	*7	*7	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1⅜	1 1/16	1 1/16	July '22, Q	0.05
Tonopah Divide	N. Y. Curb	*74	*72	*73		
Tonopah Extension	N. Y. Curb	3½	3 3/16	3½	Oct. '22, Q	0.05
Tonopah Mining	N. Y. Curb	2 1/16	1 15/16	1 15/16	Oct. '22, SA, X	0.07½
West End Consol	N. Y. Curb	1 1/16	1¼	1 1/16	Sept. '22, Q.	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb	....	....	*8	Jan. '21, M	0.01
Cardiff M. & M	Salt Lake	*40	*40	*40	Dec. '20,	0.15
Chief Consol	Boston Curb	5⅛	5⅛	5⅛	Nov. '22, Q	0.10
Columbus Rexall	Salt Lake	*16	*16	*16	Aug. '22,	0.03
Consol. M. & S	Montreal	26½	26	26	Oct. '20, Q	0.62½
Eagle & Blue Bell	Boston Curb	†*3	†*2	*3	Nov. '22, K	0.05
Federal M. & S.	New York	10	10	10	Jan. '09,	1.50
Federal M. & S. pfd.	New York	52½	50	52½	Sept. '22, Q	1.25
Florence Silver	Spokane	*36½	*36	*36	Apr. '19,	0.01½
Grand Central	Salt Lake	†*69	†*57	*61	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	9	8⅝	8⅝	Sept. '22, Q	0.15
Iron Blossom Con	N. Y. Curb	*28	*26	*27	Apr. '22, Q	0.02½
Marsh Mines	N. Y. Curb	*9	*9	*9	June '21, I	0.02
Park City	Salt Lake	3½	3½	3⅜		
Prince Consol	Salt Lake	*9	*7	*9	Nov. '17,	0.02½
Silversmith	Spokane	*45	*40	*45		
Simon Silver Lead	N. Y. Curb	*33	*31	*31		
Stewart Mines	N. Y. Curb	*6	*6	*6	Dec. '15,	0.05
Tamarack-Custer	Spokane	2.60	2.50	2.50	Jan. '21, K	0.04
Tintic Standard	Salt Lake	3.20	3.07½	3.20	Sept. '22, K	0.05
Utah Apex	Boston	3⅜	2 13/16	3 13/16	Nov. '20, K	0.25
IRON						
Bethlehem Steel "B"	New York	63½	59½	63½	Oct. '22	1.25
Char. Iron	Detroit	⅞	⅞	⅞		
Char. Iron, pfd	Detroit	2	1⅞	2		
Colorado Fuel & Iron	New York	26½	24⅝	26½	May '21	0.75
Col. Fuel & Iron, pfd.	New York	...	...	105	Nov. '22	2.00
Gt. North'n Iron Ore	New York	31	29¼	31	Nov. '20	1.50
Inland Steel	N. Y. Curb	...	...	45½	Sept. '22	1.00
Mesabi Iron	N. Y. Curb	11⅛	11	11¼		
Replogle Steel	New York	26	21	25		
Republic I. & Steel	New York	47	43½	47	May '21	1.50
Rep. Iron & St., pfd	New York	85	83	83	Jan. '22	1.75
Sloss-Sheffield S. & I.	New York	38	37½	37½	Feb. '21	1.50
U. S. Steel	New York	103⅜	99⅞	103¼	Sept. '22	1.25
U. S. Steel, pfd	New York	121½	120½	121	Nov. '22	1.75
Virginia I. C. & C	New York	55	55	55	Jan. '22	1.50
Virginia I.C.&C.,pfd.	New York	83	82	82	July '22	2.50
VANADIUM						
Vanadium Corp	New York	35¼	30⅞	35¼	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp	Montreal	67	65	65	Oct. '22, Q	1.50
Asbestos Corp. pfd	Montreal	82½	82	82	Oct. '22, Q	1.75
SULPHUR						
Freeport Texas	New York	19⅞	18½	19½	Nov. '19, Q	1.00
Texas Gulf	New York	63¼	59½	61½	Sept. '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Metal	New York	48	45	48	Sept. '22,	0.75
Amer. Metal pfd	New York	110⅜	110¼	110½	Sept. '22, Q	1.75
Amer. Sm. & Ref.	New York	54½	47⅞	54½	Mar. '21, Q	1.00
Amer. Sm.& Ref. pfd	New York	100¾	99½	99½	Sept. '22 Q	1.75
Am. Sm. Sec. pfd. A.	New York	...	...	101½	Oct. '22, Q	1.50
U. S. Sm. R. & M.	New York	38⅜	37	38	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	...	...	47⅜	Oct. '22 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Advances—Cast-iron pipe up 50c. per ton at Birmingham mill; $2.50 higher, in Chicago and rise of $4 reported in San Francisco. Yellow-pine structural timbers, base sizes, up $1 per M ft. b.m. in Chicago; $3.25, in Kansas City and $4, in both Cincinnati and Birmingham. Douglas fir, advanced $1 in Denver and Minneapolis. Hemlock, $5 higher, in Montreal. Cut nails, $3.35 as against $3 per keg, f.o.b. Pittsburgh mill. Steel pipe discounts reduced five points in St. Louis warehouses. Discounts on leather belting also lower.

General tendency of lumber and labor markets upward; cement prices stable, but iron and steel tending downward.

Declines—Steel sheets and railroad spikes, slightly lower at mill. Structural steel firm at $2 per 100 lb., Pittsburgh, as against $2@$2.10, quoted one month ago. Wire nails down 20c. in St. Louis and 60c. per keg in Dallas, during month. Douglas fir timbers, down $1.50 per M. ft. in Cincinnati; the only lumber decline of importance in ten cities, reporting. Dynamite slightly cheaper in Cincinnati and San Francisco.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Blue Annealed No. 10	$2.50@$2.60	$4.10	$4.00	$4.35	$4.19
Black No. 28	3.35@ 3.40	4.85	4.85	5.90	4.90
Galvanized No. 28	4.35@ 4.50	5.85	5.90	6.75	5.90

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$40.00	.....	$43.00
Standard openhearth rails	43.00	40.00	$43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, 9/16-in. and larger	$2.75	$2.25	$2.55	$3.65	$4.45	$3.29
Track bolts	3.85@4.50	2.25@3.50	3.65	4.75	5.45	4.29
Standard section angle bars	2.75	2.75	2.40	3.50	4.10	2 94

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.00	$2.40	$3.14	$4.40	$3.00	$3.02½	$3.35
Channel, 3 to 15 in.	2.00	2.40	3.14	4.40	3.00	3.02½	3.35
Angles, 3 to 6 in., ¼ in. thick	2.00	2 40	3.14	4.40	3.00	3.02½	3.35
Tees, 3 in. and larger	2.00	2.40	3 14	4.40	3.05	3.02½	3.35
Plates	2.00	2.40	3 14	4.50	3.00	3.02½	3.30

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Hercules red strand, all constructions	25%
Cast steel round strand rope	27½%
Galvanized steel rigging and guy rope	12½%
Round strand iron and iron tiller	10%
Plow steel round strand rope	40%
Special steel round strand rope	35%

	New York	Cleveland	Chicago
Drill Rod (from list)	55@60%	40%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Galv.	Inches	Iron Black	Galv.
BUTT WELD—	1 to 3	66	54½	⅜ to 1½	34	19
LAP WELD—	2½ to 6	63	51½	2½ to 6	32½	19

STEEL PIPE—From warehouses at the places named the following discounts for hold steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	54%	59½%	53½%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$54.30	$47.30-48.30	$43-43.50	$51.20-52.20	$49.10	$54.00

Nuts—	New York	Cleveland	Chicago
Hot pressed, sq., per 100 lb. Off list	$1.00	$3.00	$4.00
Cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1230	$0.1112	$0.0808	$0.12	$0.08	$0.108	.....
6x12x12	.1844	.1516	.1112	.....	.114	.156	.....
8x12x12	.2305	.2021	.1516	.1875	.16	.244	$0.2147

MACHINE BOLTS—	New York	Cleveland	Chicago
1½ and 1¼x3 in. up to 12 in.	20 %	50%	50%
Button head bolts, with hex. nuts	15 %	$3.90 net	.....

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers, in yards at San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$30.00	$33.00	$33.00	$35.00
3x6 and 8	30.00	33.00	33.00	36.00
4x4-6 and 8	30.00	33.00	34.00	37.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$47.00	$48.00	$46.00	$48.00
3x10 to 10x10	50.00	51.00	49.00	51.00
3x12 to 12x12	54.00	55.00	52.00	54.00

Other Cities

	8 x8-In. x 20 Ft. and Under Pine	Fir	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir
Boston	$55.00	$10.00	.....	$55.00	$65.00	$110.00
Cincinnati	44.00	48.50	$48.50	.....	57.50	50.50
Montreal	50.00	50.00	40.00	38.00	78.00	50.00
Denver	39.75	39.75	38.75	38.75	.....	39.75
Minneapolis	47.00	40.75	41.00	.....	50.00	40.75
Kansas City	38.75	47.00	47.00	49.50	52.75	49.00
Birmingham	32.00	.....	.....	.....	40.00	.....

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.70	$3.10	$4.00	$4.40	$3.40	$4.95
Cut	3.35	5.50	5.65	7.75	5.50	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.60	$2.60	$2.40
Chicago, f.o.b.	2.20	2.20	1.97
Cleveland, f.o.b.	2.46	2.46	2.28

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel 280-lb.net Finishing	Lump, per Barrel 280-lb.net Common
New York	$16.80@$17.10	$13.10	$3.63½	$2.75@$3.13½
San Francisco	22.00	16.00	.....	(180-lb net) 1.75

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.90	$0.72	$0.95	$0.76

WHITE AND RED LEAD—Base price in cents per pound:

	Red Current Dry	Red Current In Oil	Red 1 Year Ago Dry	Red 1 Year Ago In Oil	White Current Dry or In Oil	White Yr. Ago Dry or In Oil
100-lb. keg	13.25	14.75	12.25	13.75	13.25	12.25
25 and 50-lb. kegs	13.50	15.00	12.50	14.00	13.50	12.50

HOSE—

	Fire	50-Ft. Lengths
Underwriters' 2½-in. coupled		49½c per ft.
	Air	
	First Grade	Second Grade
¾-in., 3 ply per ft.	$0.31	$0.22½

Steam—Discounts from List

First grade ..... 50-5% Second grade ... 50-10% Third grade 60%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:

Competition ..... 65–10% Best grade 60–5%

LEATHER BELTING—List price per ply, 12-in. wide, per lin. ft. $2.88.

Grade	Discount from list
Medium	30–10%
Heavy	20–5–2½%

RAWHIDE LACING—For cut, best grade, 40%, 2nd grade, 50%. For laces in sides, best, 48c. per sq.ft.; 2nd, 43c. Semi-tanned: cut, 40%; sides, 48c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ½ in.	$0.90
Rubber sheet	.45
Rubber sheet. wire insertion	.70

MANILA ROPE—Per lb., ¼-in. and larger, 1,200-ft. coils.

Atlanta	$0.20	New Orleans	$0.17½
New York	.17	Seattle	.18
Chicago	.19	San Francisco	.16

COTTON WASTE—The following prices are in cents per pound:

	New York	Cleveland	Chicago
White	9.00@11.50	12.00	11.25
Mixed	6.50@10.00	9.00	8.00

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.30
Minneapolis	.189	.2094
Denver	.2025	.2325
Seattle	.165	.195
Cincinnati	.215	.245
New Orleans	.235	.265
San Francisco	.1625	.1925

FLOTATION OILS—All prices are per gal., f.o.b. New York unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight 500 lb.

Pine oil, steam dist., sp.gr., 0.930-0.940	gal.	$0.90
Pine oil, pure, dest. dist.	gal.	.85
Pine tar oil, ref., sp gr. 1.025-1.035	gal.	46
Pine tar oil, crude, sp.gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla	gal.	.35

NEW MACHINERY AND INVENTIONS

A Rapid Blow Rivet Cutter

On the principle that when cutting rivets a number of comparatively light, rapid blows cause more vibration and therefore more distortion of steel plates than a few intermittent, heavy blows, the Chicago Pneumatic Tool Co., of New York, has designed and manufactured a new type of rivet cutter known as the "Boyer Superior." It consists of a dead handle, a throttle handle of the crank design, a throttle valve of the taper type, a back head screwed on to the cylinder and secured by a locking device, a cushion chamber in the rear end of the cylinder, a cylinder of seamless steel tubing, a bypass from back to front head, a non-removable electrically welded front head, square coiled spring buffer, adjustable chisel lock, hand hold of the spade handle type, and chisel.

To operate, the throttle handle is moved in a line parallel with the cylinder. Each forward and return stroke of the piston is hand-controlled. About four blows, requiring approximately ten to fifteen seconds, are said to be required to cut off the head of a ¾-in. rivet. Two men are required to operate the machine. It can be used wherever rivets are to be cut.

INDUSTRIAL NOTES

The Wilson Welder & Metals Co. is now represented exclusively in Maryland, Virginia, and the District of Columbia by the Alexander Milburn Co., of Baltimore, Md.

George Macnoe, manager of the Boston office of W. B. Connor, Inc., has been recalled to New York to take charge of the contractors' sales department, handling heating and pumping equipment.

TRADE CATALOGS

Transits and Levels—Warren-Knight Co., 136 North 12th St., Philadelphia, Pa., have recently issued a 32-page pamphlet illustrating and describing the "sterling" transits and levels. Several new features are included in the various models. Field and drafting room equipment are also listed.

Air Meters—The New Jersey Meter Co., Plainfield, N. J., in a 4-p. bulletin outline the principle and applications of the company's Tool-om-eter and Drill-om-eter. These devices increase the consumption of any tool, machine, or process operated by compressed air and the actual net output of any compressor or pump within its capacity. The Tool-om-eter has a capacity of 10 to 100 ft., and is recommended for most small tools rated by manufacturers at not over 60 ft. per minute when new. The Drill-om-eter has a capacity of 50 to 300 ft., and is adapted to mounted rock drills, and similar machines where the actual consumption is not over 300 ft. per minute.

Gold Dredges—The New York Engineering Co., 2 Rector St., New York, has recently issued a booklet, "The Business of Gold Dredging," which not only describes the work of this company, but also presents an interesting story of the dredging business. The various steps of a dredging project are outlined, numerous examples of successful operations are given, and the different methods are explained. The booklet contains much data that will be of benefit to those interested in gold, tin, or platinum dredging. One chapter is devoted to placer prospecting methods, another to hydraulic elevators as successfully employed in many hydraulic mines, and the last chapter deals with the financing of placer enterprises.

Helical Gears — "Nuttall Helical Gears" is the title of a 20-page booklet recently issued, as Bulletin No. 34, by the R. D. Nuttall Co., Pittsburgh, Pa. The various advantages of helical gears are mentioned: Silent running, minimum vibrations, increased life, less wear on adjacent equipment, adaptability of existing spur and herringbone applications, permit larger ratios than spur gears, improved tooth design, and increase in strength. Illustrations of the applications of these gears to different industrial services, including mines, mills and factories, are shown.

The Nuttall company has also issued a special booklet, "Proportion of Industrial Gears," which has been prepared by G. E. Katzenmeyer. A number of charts, by means of which gears can be calculated, are attached. These will be found to be quite thorough.

Heat Treatment of Drill Steel

All mining men agree that much depends on the proper shaping and hardening of drill steel. Care and experience are required, for the best steel can be spoiled by unsuccessful and unskilful heat treatment.

Beyond doubt a machine for sharpening is better than hand forging. In forging, it is important to avoid overheating. If such accidentally has taken place, the steel should be allowed to cool down and then be reheated to a normal forging temperature of 1,650 deg. (dark orange color).

After forging, the steel should cool completely and be reheated to 1,450 deg. (light cherry color). A good way to harden the bit is to keep the drill in a vertical position and move the edge in a circle in a quenching medium of clean water until the edge is quite dark. The drill can then be left standing in the water to a depth of about § in., until the steel have been completely cooled.

The hardness of the bit should be varied according to the hardness of the rock. A good blacksmith can determine this easily. The temper of the steel can be drawn to a yellow or blue color and this can be done in a separate heat, or by allowing the heat remaining in the steel after rehardening to reheat the bit to the desired temperature. The shanks should be hardened about 8 in. in soluble oil at a temperature of 1,550 deg. and allowed to cool down completely.

The foregoing suggestions are incorporated in a 4-page leaflet prepared by the Swedish Charcoal Steel Producers, Inc., 165 Broadway, New York, entitled "S K F Steel in the Mining Industry." In the preparation of their hollow steel, the original "sand core" method is used. Several advantages are claimed for this method. In preparing the billets, a hole is drilled through the center, thus removing those parts of the ingot where possible existing impurities would be found. The holes are smooth and round throughout the length of the bar, even in difficult sections such as quarter-octagon and similar shapes.

CONSTRUCTION NEWS

New Steel-lined Mine Shaft in Minnesota

The Section Thirty Mining Co., operating near Ely, Minn., on the Vermilion Range, is sinking a new shaft which will permit the mining of a body of ore at a lower horizon than any present level. This ore has been disclosed by recent diamond drilling. The new shaft is to be 1,500 ft. deep and 10 x 18 ft. in the clear. It will have five compartments and will be steel lined. The compartments will be for a cage, two skips, and ladder and pipe ways.

Contract Is Let for New Cornelia's 5,000-Ton Concentrator

The New Cornelia Copper Co. has awarded a contract to the El Paso branch of the Wisconsin Bridge & Iron Co., for its new 5,000-ton concentrator at Ajo, Ariz. Construction is to be started about Jan. 1. An addition is also to be built to the present power plant, and many new laborers' dwellings are to be erected.

Stargo Mines Co. Will Have Flotation Plant

The 75-ton cyanide mill of the Stargo Mines Co., now being constructed by the General Engineering Co. at Morenci, Ariz., will be ready for operation about Dec. 15. The company owns thirty claims producing gold and silver. Ray Ferguson is manager.